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USSR REPORT

SCIENCE AND TECHNOLOGY POLICY

No. 14

CONTENTS

SOVIET RESEARCH ON GENETIC ENGINEERING DESCRIBED

Moscow EKONOMICHESKAYA GAZETA in Russian No 19, May 83 p 2

[Article by Academician Yu. A. Ovchinnikov, Vice-President of the USSR Academy of Sciences, leader of programs in physicochemical biology and biotechnology, under rubric "Scientific-Technical Programs": "Modern Biotechnology"]

[Text] At the present time, progress in understanding living matter is, to a considerable degree, influenced by the intensive development of the reciprocally linked scientific disciplines that study the physicochemical foundations of vital activity, particularly biochemistry, biophysics, jolecular biology and molecular genetics, immunology, and bioorganic chemistry. This total set has been given the name of physicochemical biology.

A scientific-technical program on the problem "Develop new directions of research in the genetic apparatus, biopolymers, and the structures of the cell, which carry out the most important manifestations of vital activity; and introduce the achievements of molecular biology and molecular genetics into the national economy" is devoted to the development and practical application of this set of disciplines in the national economy.

Fundamental Research

The research that is being carried out according to the program encompasses very important biopolymers--proteins, nucleic acids, polysacchardies, and their complexes. Low-molecular weight bioregulators (neuropeptides, hormones, prostaglandins, pheromones, etc.) are being studied. A large amount of importance is attached to the study of biological membranes, which play an important role in almost all processes that occur in cells, tissues, and whole organisms.

All these projects open up broad opportunities for penetrating into the molecular mechanism of such delicate processes of vital activity as the organism's immune response, biological reception, behavior, sleep, memory, emotional sensations, and the activity of the heart and muscles. Understanding the physicochemical basis of these processes opens up the prospect of their directed regulation. And these are, first of all, new methods of treating cardiovascular and oncological diseases, nervous-mental dissorders,

and infectious diseases. Secondly, the achievements of physicochemical biology are already making a contribution, and will make an even greater contribution to the fulfillment of the USSR Food Program.

The chief task of the program in physicochemical biology is understanding the nature of vital activity at the molecular level, the creation of a backlog of fundamental knowledge on the basis of which projects are developing, and will continue to develop in a greater and greater volume, in the applied areas of biology, in medicine, agriculture, and the microbiological a d food industry.

The achievements of physicochemical biology have brought to life new trends in biotechnology.

Biotechnological methods have been employed from time immemorial in economic activity. Without them we would not have, for example, such ancient production entities as bread-baking, winemaking, cheese-making, or the obtaining of alcohol by fermentation.

Modern biotechnology is a comprehensive, multi-specialized area of scientific-technical progress, which includes such sections as micribiological synthesis in its broad understanding, genetic and cellular engineering, and engineering enzymology. It is precisely these new trends in biology that have been called upon to contribute to the resolution of the vitally important problems of medicine, and we count on them also when implementing a number of important principles stated in our country's Food Program.

The comprehensive scientific-technical target program "Development of biotechnological methods of obtaining products that are valuable for medicine and agriculture and for introducing them into production" has been called upon to accelerate the carrying out, "from the initial concept to the plant," of the achievements of physicochemical biology which are most essential from the point of view of practice.

Heredity Engineering

First, the topic of discussion is genetic engineering. The chief goal confronting it lies in the obtaining of proteins of man and animals. This is necessary for the protection of public health and other areas of practical activity.

Genetic engineering is the artificial designing of the hereditary material--deoxyribonucleic acid (DNA), that is, the introduction of information that is needed for man and that is alien to the particular organism, into the hereditary apparatus of microorganisms, plants, and animals. In particular, this approach makes it possible even now to obtain, with the aid of bacteria, proteins that are important for medicine, which were previously produced only by the human organism. Along the same path, most likely, other methods of combatting hereditary diseases of man can be found.

One of the most important objects of genetic engineering is interferon, or, rather, interferons, since each organism has several varieties of them. These proteins are produced by the cells of man and animals and are a universal antivirus means.

Interferon is specific for each species. Therefore, in order to cure people, one can use only human interferon. This preparation is obtained from very expensive raw materials--leucocytes of donor blood. A 24-hour dose for one patient requires 10 liters of leucocyte culture. Keeping in mind the abundance of viral infections (even without taking epidemics into consideration), one can conclude that the existing method is incapable of providing the necessary quantity of the preparation.

Something that can become a fundamentally new source of interferon is microbiological producer-strains--bacteria or yeast--that have been designed with the aid of genetic engineering. This work is being carried out within the frame work of the program for biotechnology.

In order to obtain genes of interferon, two methods are used. First, the production of the gene from leucocytes that have been induced by virus. A producer-strain has been created on this basis. Projects are under way to create on its basis an industrial method for obtaining interferon. The other alluring method is the chemical synthesis of the interferon gene. This process is complicated. It is necessary to synthesize not only the so-called structural gene, but also the sectors that are needed for it to "work" in the cell of another organism. All this together constitutes approximately 1200 nucleotides--one of the largest molecules of biopolymers that have ever been created by an. These projects are being carried out successfully by the joint efforts of the Institute of Bioorganic Chemistry imeni M. M. Shemyakin, of the USSR Academy of Sciences, and the NII [Scientific-Research Institute] of Glavmikrobioprom.

The production of insulin by methods of genetic engineering will be of great importance. The lack of insulin in the organism leads to a serious disease--diabetes. The preparation that is usually used for treatment is insulin of animal origin. However, it has been proved that a large number of people cannot withstand that preparation, and need human insulin. Thus ther arose the idea of using the capabilities of chemical synthesis, but that has proven to be a very expensive situation.

Genetic engineering has opened up a more profitable way to obtain human insulin. Without the framework of the biotechnology program, that work is close to completion. The Institute of Bioorganic Chemistry imeni M. M. Shemyakin has carried out the complete synthesis of the synthetic gene of the insulin precursor--human proinsulin. The producer-strain is being engineered on that basis.

The Institute of Molecular Biology, USSR Academy of Sciences, has created, by methods of genetic engineering, a producer-strain for somatotropine--the human growth hormone that is needed for treating dwarfism, burns, and bone fractures. At the present time projects are under way to create the industrial technology for the obtaining of this substance.

Cellular Engineering

Recently extremely interesting results have been obtained in another area of modern biotechnology--cellular engineering. First of all, this is the creation of hybrid cells--hybridomas--for the obtaining of monoclonal antibodies of the assigned specificity.

Participating in the formation of the hydridomas are lymphocytes of the spleen of immunized animals and cancer (myeloma) cells. As a result of their fusion, one obtains a hybridoma, which combines the ability to multiply just as rapidly as cancer cells, and to produce one and only one type of antibody, as a parent plasmatic cell.

The target program has stipulated a broad work front for the obtaining of monoclonal antibodies for various purposes. One can note definite success. Preparations for diagnosing a number of diseases of man and agricultural animals have been created and are being prepared for introduction into practice.

The use of cell cultures is an extremely promising area. If they are grown on synthetic nutrient media, they can produce very valuable substances that are produced under natural conditions only by the entire organism.

First of all, these projects include the cultivating of cells of a number of plants with the purpose of obtaining the products synthesized by them. For several years enterprises of Glavmikrobioprom have been obtaining tincture of ginseng from a cellular biomass on the basis of a method that was developed at the Institute of Plant Physiology imeni K. A. Timiryazev. A new and more economical method is now being introduced. In addition, methods are being developed for the purpose of cultivating cells of certain other plants to be used to obtain medicinal preparations.

The program reflects the use of a unique property of the vegetable cell--its ability to give a beginning to the entire plant. This makes it possible, with the aid of selection and hybridization on a cellular level, to create rapidly new varieties of agricultural plants that have a high harvest yield and that are resistant to diseases and plants. It is planned to organize by this method the reproduction of planting and selection material, newly created and economically assimilated varities of potatoes, sugar beets, alfalfa, and certain other crops on a production scale.

A large amount of damage is inflicted on agriculture by viral diseases of plants. The biotechnology program has defined a comprehensive approach for combatting them.

On the one hand, there is the breeding of varieties that are resistant to viral diseases, by means of selection; on the other hand, the obtaining of

uncontaminated planting material by methods of microclonal reproduction. This is being achieved by means of the creation of large quantities of genetically identical copies of the initial plant as a result of cultivation in a nutrient medium of the most actively growing parts of the plant (for example, the buds).

In order to combat viral diseases of plants, highly sensitive methods have been created for diagnosing the contamination rate of plants, with the use of immune-enzyme analysis and certain other methods.

Enzymes Are Working

Immune-enzyme analysis, which arose in the area where immunology and enzymology abut, is beginning to be introduced broadly into practice in medicine, agriculture, and the microbiological and medical industry, for monitoring the rate of pollution of the environment--wherever it is necessary to have mass, precise, inexpensive, and high-speed methods of analysis, based on the principle of "recognition" by the antibodies linked with the polymer matrix of the antigens that are peculiar to the substance being studied.

Another practical branch of enzyme research is engineer enzymology, that is, the use of enzymes as biocatalysts for the industrial production of necessary substances. In a number of instances, for greater convenience in work and for their repeated use, the enzymes are "immobilized"--they are bound chemically with the appropriate carrier.

On the basis of enzymatic synthesis it is planned to organize the industrial production of prostaglandins--biologically active substances that are very promising for application in medicine, as well as in animal husbandry and veterinary science. This has been developed at the Institute of Chemistry, ESSR Academy of Sciences and is being assimilated at its experimental plant.

A technology is being created for enzymatic production of glucose from the cellulose in cotton lint. The carrying out of this process will make it possible to increase by many times the production of the valuable product and will yield a large economic benefit.

An important role in the intensification of animal husbandry is played by the creation of protein-balanced fodders. For that purpose, a technology is being developed for obtaining very valuable fodder proteins from vegetable raw materials, for example, from alfalfa and clover.

The technological processes being created guarantee the reduction of the losses of the biological part of the harvest, and the reduction of the energy expenditures as compared with the traditional methods, and makes it possible to carry out the balanced feeding of agricultural animals and poultry.

At the Area Where Sciences Abut

The coordination of all the projects in both programs and the monitoring of them have been made the responsibility of the Interdepartmental Scientific-Technical Council of Problems of Physicochemical Biology and Biotechnology, under the USSR State Committee on Science and Technology and the Presidium of the USSR Academy of Sciences. That council has been granted the right to make decisions that are mandatory for all ministries and departments.

In the implementation of the comprehensive target program for biotechnology noticeable successes have already been achieved in comparatively short periods of time. Certain developments with the use of methods of genetic engineering are one or two years ahead of the deadlines stipulated by the program.

At the same time, difficulties have also become noticeable. In particular, it is obvious that if the organizations which have been given the responsibility of creating the technological schemes and the equipment for the future production entities do not become involved in the job at the very earliest stages, but, instead, wait for the total completion of the laboratory research, the deadlines for the organizing of the industrial production of many products may not be met. One is alarmed by the fact that a number of ministries and departments have not been concentrating their material and labor resources that have been stipulated by the program in the resolution of the key tasks, but, instead, have been dispersing them in less important topics. Individual managers continue to have the idea that the programs must be fulfilled exclusively or almost completely by means of additional investments. They do not provide for the supporting first of all of the projects in state programs by drawing on the fixed assets of their own branches, as should be the case.

The creation of production entities that are based on the latest achievements of science requires very careful attention and provision instruments, equipment, and raw and other materials. It is necessary to overcome difficulties in this area which are still rather considerable. This pertains especially to the providing of chemical reagents and biochemical preparations. It is necessary for a more attentive and more responsible attitude to this question to be taken by the Ministry of the Chemical Industry and by Glavmikrobioprom.

Naturally, during the creation of production entities that are based on the use of new technological schemes, one frequently encounters problems which were impossible to foresee during the development of the programs. Frequently, in order to resolve these questions, it is necessary to involve ministries and departments that are not participants in the program, and, that, consequently, do not have the corresponding assignments in their own plans. It must be assumed that such questions arise during the implementation of many other programs. It would seem to be desirable to provide for

definite reserves to be left at the disposal of the USSR State Committee on Science and Technology.

Biotechnology is a new stage in the synthesis of modern biological knowledge and technological experience. Having arisen in the area when different trends of science abut, it is developing rapidly.

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SOVIET TV SHOWS ACADEMY OF SCIENCES MEETING

[Editorial Report] Moscow Domestic Television Service in Russian at0755 GMT 9 Mar 83 carries a 30-minute report by journalist Andrey Skryabin from the Moscow House of Scientists on the Annual General Meeting of the USSR Academy of Sciences. Taking part in the meeting are: Mikhail Vasilyevich Zimyanin, secretary of the CPSU Central Committee; Academician Anatoliy Petrovich Aleksandrov, president of the USSR Academy of Sciences; Academician Petr Nikolayevich Fedoseyev, vice president of the USSR Academy of Sciences; Academician Yevgeniy Pavlovich Velikhov, vice president of the USSR Academy of Sciences; Academician Georgiy Konstantinovich Skryabin, chief scientific secretary of the USSR Academy of Sciences; Academician Yuriy Anatolyevich Ovchinnikov, vice president of the USSR Academy of Sciences; and Academician Guriy Ivanovich Marchik, deputy chairman of the USSR Council of Ministr.

Andrey Skryabin begins the reportage by citing the number of scientists working at the Academy of Sciences and describing the reason for the meeting, "Which is an annual event to sum up the activity of the Academy and to present various awards to distinguished scientists." He then introduces the agenda of the meeting and notes that the morning session is devoted to life and activity of Karl Marx. He also outlines the activity of the Academy in 1982.

While the camera pans the presidium and the audience, Aleksandrov opens the meeting by saying: "We have divided our general meeting into two parts: the morning session today, as you know, is devoted to notable events in the life of Karl Marx." Immediately after Aleksandrov speaks, Academician Fedoseyev is shown speaking from the rostrum. Andrey Skryabin summarizes Fedoseyev's speech, while medium and close shots of Zimyanin and Aleksandrov in the presidium are provided, followed by medium shots of Academician Ovchinnikov, speaking from the rostrum. Andrey Skryabin again provides the summary of Ovchinnikov's speech which is on Marxism and scientific-technical progress.

In the interval between the sessions Andrey Skryabin interviews Academician Fedoseyev, who dwells on historical developments of Marxism and the importance of Marx' teaching in the present.

Following the interview, Academician Aleksandrov is shown opening the evening session. He states: "We scientists are now confronted with a particular demand to accelerate the scientific technical progress in our country. A number of concrete tasks have been set in this field. These are: improving the situation in the fields of ferrous and non-ferrous metallurgy and in field of machine building, particularly by paying attention to the length of service of machines and mechanisms produced by our industry, particularly by paying attention to the length of service of machines and mechanisms produced by our industry. Overuse of materials in various spheres of our industry has also been noted in regard to the machine building and construction fields. An extremely difficult situation is developing in the field of chemistry and chemical production. Remarks have also been made in connection with the food program, that is, in connection with all kinds of biotechnology and the production of herbicides, various substances for regulating plant growth, such as pheromones and so on." From this point Andrey Skryabin summarizes the continuation of Aleksandrov's address on the achievements of the Academy's various institutes, while the camera pans the presidium members and the audience. Aleksandrov is shown concluding his address by saying that "Today we are faced with the task of speeding up the introduction of scientific findings into industry. For this purpose we have begun to undertake--we, in fact, did this before only to a lesser extent--joint work with the ministries such as the organization of a joint laboratory, at our own expense, which would carry out the work by the given plan. Thus when the work is completed, the industry will have at its disposal its own collective which can handle this type of work, and this will greatly assist the incorporation of our findings into the industry, because this eliminates all the departmental contradictions and all the bureaucratic contradictions and barriers."

Aleksandrov's address is followed by Academician Skryabin's report on the activity of the Academy in 1982. Andrey Skryabin summarizes this report. He also notes that a section dealing with informatics, that is, informational science, has been established at the Academy. He also interviews Velikhov on the reasons for the creation of this section. Velikhov describes at length the role of informatics in science and its practical application. He concludes that "This is indeed a process of creating powerful mathematical machines, mathematical models for managing contemporary society and for solving complex contemporary tasks in ecology, economy and industry."

Andrey Skryabin then interviews Academician Skryabin who cites many great achievements of the Academy and complain that these achievements are not being introduced for practical purposes rapidly enough. On the question of international ties, Academician Skryabin states: "I can say this: everyone knows about the growing role of science in the world of politics, this is understood by all. Everyone knows about the growing role of international scientific cooperation, international cooperation of the people of all those countries. Therefore, the Academy of Sciences pays attention to international ties, very serious attention. I must say that

the ties of the Academy of Sciences are widespread. I will give a few examples. Over 6,000 scientists visited us from the socialist countries alone. Over 5,000 of our scientists also went on visits, over 5,000 from capitalist countries also visited us, and we in turn sent about 4,000 there. Science now is strong through its internationality, its complexity. Even the richest and the biggest country cannot do everything in science. There must be cooperation. I must say this: of course ties with American scientists are important to us. They are profitable for us. However, American ties with our science are no less profitable for the Americans. By the way, despite all the efforts of the U.S. Administration the development of international scientific ties of our Academy and of the Soviet Union are constantly progressing with all the countries, including even the United States." Academician Skryabin concludes the interview by outlining the tasks facing Soviet scientists.

Andrey Skryabin concludes the reportage by citing the appeal of the General Meeting to Soviet scientists and the proposal for conducting an all-union conference "Scientists in Defense of Peace." The meeting concludes with the presentation of awards of a number of scientists including Professor Dorothy Hodgkins member of the London Royal Society, foreign corresponding member of the USSR Academy of Sciences, for her achievements in natural science.

CSO: 1814/116

NEW LENINGRAD SCIENCE CENTER DISCUSSED

Moscow IZVESTIYA in Russian 5 Mar 82 p 2

[Interview with Academician I. A. Gelbov, chairman of the Presidium of the USSR Academy of Sciences Leningrad Scientific Center, by Correspondent V. Nevelskiy: "New Scientific Center"--first graf is IZVESTIYA introduction, Leningrad, date not specified]

[Text] Yet another institution, in addition to the existing ones--the Siberian Department and the Ural and the Far Eastern Scientific Centers--has appeared on Russia's academic science map, the Leningrad Scientific Center. IZVESTIYA Correspondent V. Nevelskiy turned to Academician I. A. Glebov, who has been elected chairman of the Presidium of the USSR Academy of Sciences Leningrad Scientific Center, and asked him to describe the goals and tasks which have been set the center.

Nowadays, with the accelerating rate of scientific and technical progress and the increasing efficiency of research and development, a special role is assigned to close coordination between the collectives representing academic, sectorial and vuz science, Academician I. Glebov said: Much changed for the better in this respect with the appearance of the USSR Academy of Sciences Interdepartmental Coordinating Council. It enabled us to unite the efforts of collectives in the northwest of the country, which were previously uncoordinated, and to coordinate the fundamental and basic research carried out in the region.

However, experience has shown that all this is insufficient. The question of administering the activity of the tens of academic establishments in Leningrad and its oblast still remained unresolved. In conditions where each of them was locked in on the corresponding Moscow Institute or Academy Department it was difficult to form a clear idea of what they were all doing as a whole.

After all, the success of a scientific collective's work depends on many factors: the standard of the administrative leadership's scientific organizational work, the staffers' diligence and skill, their rational utilization of work time, the improvement of creative contacts with sectorial institutes and enterprises and finally the reduction of the time taken to introduce scientific developments. The reserves here are still

very great. We must more purposefully seek to ensure better use of our research results and identify the most important comprehensive scientific tasks.

It is with precisely this aim that the Leningrad Scientific Center has been created. Uniting Academy of Sciences scientific establishments and organizations, it must ensure the efficient and timely coordination of their activity and more careful monitoring of progress in fulfilling their plans and promote the accelerated development of their material and technical base.

In the near future the construction of a science city [Akademgorodok] will develop on the city's northern outskirts at Shuvalovo, and in time the academic establishments and organizations will move there from their old buildings.

The creation of a single center with a computer complex for collective use is of great importance in raising the Leningrad Institutes' efficiency.

I should particularly like to emphasize that the scientific and scientific methodological leadership of the scientific establishments is remaining with the relevant Academy of Sciences departments. We set as our task the strengthening of the existing system of academic science management and the enhancement of its efficiency. The Interdepartmental Coordinating Council will also retain its authority. We will be extending it every possible assistance in coordinating the research carried out in the northwest and northern economic regions.

CSO: 1814/115

IMPROVED LEGAL BASIS OF ADOPTING NEW TECHNOLOGY PROPOSED

Moscow KHOZYAYSTVO I PRAVO in Russian No 1, Jan 83 pp 60-63

[Article by Doctor of Legal Sciences M. Ring, senior scientific associate of the USSR Academy of Sciences Institute of Government and Law: "The Legal Basis of Adopting New Technology"]

[Text] The adoption of the results of research and development is an urgent and difficult problem of scientific-technical progress. In connection with this, the report of the 26th CPSU Central Committee Congress emphasized: "The decisive and most pointed issue of the day is the adoption of scientific discoveries and inventions. Scientific-research and project-design work must close ranks--economically and organizationally--with industry."[1]

Legal factors are among those which give rise to these problems. They include flaws, in particular the fragmented, contradictory, and incomplete nature of the legal regulation regarding the adoption of scientific-technical achievements. It would seem that the existing legal basis of the use of new technology is on the whole not effective enough and requires substantial modernization.

This basis includes legislative norms concerning science and the use of its achievements, and norms of economic law, civil law, administrative law, labor law, and a number of other branches. It needs to be improved in various directions and aspects. We will discuss those which are, in our view, the most essential: how to use the law to consolidate the most important economic and organizational solutions to the problem of adopting new technology.

The 26th CPSU Congress, as is well known, proposed the task of "eliminating everything which makes the process of adopting new technology difficult, slow, and painful."[2] Adopting technology is a continuous process of gradually obviating, neutralizing, and clearing away difficulties and obstacles in the path of utilizing the results of research and development. Consequently, adoption is an inseparable element of efforts in the field of science, new techniques, and progressive technology, a necessary condition for them, and obtaining the results of research and development is

only a partial realization of the process of adopting them. The final result--the wide use and dissemination of scientific-technical innovations--is the culmination of the adoption process. Adoption, as a gradual process, begins with the use of experimentally obtained results within a single field and ends with their practical utilization.

Gradual adoption means that the final application of research and development cannot occur without the initial utilization, followed by intermediate utilization. They depend on each other in exactly the same way that every final product is determined by a multitude of intermediate links, by a system of intra-sector and inter-sector connections. For example, the implementation of the results of fundamental research is accomplished, as a rule, within the bounds of science, since they serve as the basis for applied research. A large body of applied research is also used only within science, inasmuch as it serves as the basis for working out technical tasks or basic documents for completing technical and technological applications. The theory of gradual adoption makes it possible to avoid dangerous extremes in which either the initial and intermediate utilization is passed off as the end result, or in which not enough attention has been given to initial and intermediate stages of adoption, and the effect of final utilization is reduced.

This explanation agrees with many existing legal acts and the way they are applied in practice. Of special interest in this connection are the legal acts of sectors which have converted to the self-financing system of new technology projects. A number of such acts directly confirm the existence of the beginning stages of adopting research and development, and call for planning the subsequent broad utilization of the results of such projects in the production process.

It seems expedient to codify the existence of gradual adoption of achievements in science and technology, giving legal force to the following propositions: the use of particular results of research and development is initially implemented in order to conduct other research and development; adoption continues on successive planes and stages; adoption will be considered complete when there is a raised level of technical-economic indicators and other indicators of production, increased production output and goods, work and services performed, and also the resolution of social and other practical tasks. In addition, legislation should stipulate that the final adoption of new technology and equipment be translated into industrial assimilation of the objects of new technology, technological processes, and materials, and the use of new production and use of advanced types of goods as well as the production and use of advanced types of goods and technologies that have been assimilated or are in the process of being assimilated.

While it is impossible to use the achievements of science and technology without gradual adoption, and adoption is accomplished where the research is carried out and its results assimilated, still they have the very same legal constraints. Hence it appears to be possible to draw two important conclusions for improving the legal basis of adoption: existing legal acts

take an essentially correct position when they do not separate the legal regulation of planning, financing, and economic stimulation of the adoption of research and development from their creation and assimilation; there can be no legal act specifically devoted to the adoption of what has been created by science and technology separate from a legal act which regulates scientific-technical achievements with regard to development, assimilation, and use.

In our opinion, these general propositions should be embodied in individual legislative norms concerning science and the use of its achievements. For example, a norm concerning planning, the supplying of resources, and stimulating the adoption of scientific and technological achievements are to be worked out and approved concurrently and jointly with the planning, supplying of resources, and stimulation of development of science and technology.

From the position of state interests, new technology can be considered completely adopted when it has come into mass distribution and satisfies the requirements of the various sectors and the national economy as a whole. Who is to be responsible for this final stage of the process of creating, assimilating, adopting, and disseminating new technology? It seems economically unfeasible and legally impracticable to impose the duty of disseminating the final results to other sectors on individual participants in the process. This duty can and should rest jointly on the ministry which has authority over the scientific and technical organizations, associations, and enterprises developing, assimilating, and adopting the new technology, and on the ministries which are consumers of technical and technological achievements. If, however, the final results of a goal-directed integrated scientific-technical program or a program for resolving a difficult problem are to be disseminated on a national economic scale, then the responsibility for this duty should rest on the head ministry (or other program-goal-oriented administrative organ) which is responsible for fulfilling the program as a whole, and also on the collaborating and using ministries.

The legal basis of utilizing new technology is called upon to clearly and logically regulate two indispensible conditions of its adoption: the ability and economic motivation of scientific and technical organizations, scientific-production associations, and specialized adoption organizations to prepare the results of research and development appropriately, at the right time, for delivery to production associations and enterprises; and the ability and economic motivation of production associations and enterprises to make timely and appropriate preparation of the economic, material-technical, technological, organizational, cadre, and all other conditions for receiving these results, and continuing and completing work on them.

The resolution of the problem of adopting new technology comes down in the final analysis to economic, organizational, and legal guarantees of fulfilling these important conditions. The entire mechanism of self-financing system of projects of new technolgoy, one way or another, directly or indirectly, in mediated or unmediated fashion, must serve this purpose. The readiness of the results of work on new technology and equipment is

manifested, first, in how well their technical-economic and other indicators correspond to the best examples of domestic and foreign science and technology, the specific conditions of the production associations and manufacturing enterprises, and the needs of consumers; and, second, in their readiness for practical application.

In certain sectors of industry, where the self-financing system of new technology projects has been introduced, interesting experience has been accumulated on the timely preparation for adoption, and an effective system of connections has been formed which can be called advance preparation for the adoption of scientific-technical advances in industry. The existing departmental legal acts in these sectors call for a definite procedure of organization as well as maintenance of the connections mentioned. Thus, the manufacturer of a new product is determined by the plan assignement or appointed by a higher organ. In developing a new technology and the custom equipment needed for it, the operating (or under construction) enterprise in which the new technology and custom equipment is to be adopted in production (or installed) requires the rights and responsibilities of client. If the planned item of production is to be manufactured at several enterprises, a head manufacturing enterprise is designated to establish direct connections with the scientific or technical organization doing the research and development. Designation of the manufacturing enterprise occurs at the stage of assigning the technical task, the stage of preliminary design, or the stage of technical design. If the manufacturing enterprise is determined at the stage of drafting the technical assignment, then it is brought into the coordination of this task.

The enterprise manufacturing the new product in its turn designates representatives responsible for the following: to study the planned article; to become familiar with the technical processes that go into it and the products and materials that will have to be purchased for it; to seek out the specialized forms of technical equipment which will be needed in the future for producing the new item; to make provision for the measures which are required to prepare for timely production; andtto evaluate the advisability and capability of conducting separate experiments on the item under development on the manufacturing enterprise's own equipment and gear. In addition, the manufacturing enterprise's responsibilities include making recommendations to the scientific or technical organization on the following questions: coordinating the design documentation with standards in effect at the enterprise; using parts and assembly units manufactured at the enterprise in producing the planned article; and using the gear, technological processes, and equipment already existing in the enterprise for the planned item. The decisions taken by the responsible representatives of the parties involved, after examination and approval of the recommendations listed, are binding on the future work of the scientific and technical organizations. It is necessary to add that representatives of the manufacturing enterprises take part in conducting all sorts of tests on experimental samples of the new equipment.

The entire legal basis of adopting new technology should juridically guarantee the readiness of research and development for practical application. An

effective measure here, in our view, might be a regulation which considers a planned task unfulfilled, and economic agreements and commissions unmet, until the results of the projects are ready for adoption. Such preparation cannot be one-sided. Technical, economic, organizational, and other types of preparation for production are the other side of the coin of making adoption possible.

Here the legal regulation is full of gaps. It should be filled in with precise and logical legal regulation of the procedure of technical, economic, and organizational preparation for adoption. With this goal in mind, it is desirable to stipulate, by sector standards and other departmental and local legal acts, the full range of norms determining the rights and responsibilities of associations and enterprises responsible for adoption.

As economic research and practical analysis show, one of the most important responsibilities in preparing for adoption is discontinuing the manufacture of obsolete products and replacing outmoded technological processes. Otherwise, we cannot hope to overcome the obstacles in the path of realizing scientific and technical innovations, and it would be unfeasible to expect effective acceleration of the adoption of scientific-technical achievements, more rapid renovation of the goods produced, and better quality.

In order to regulate this responsibility, at least three issues must be resolved: defining the terms "obsolete products" and "outmoded technology"; regulating the procedure of taking obsolete products out of production and replacing outmoded technology; providing for these measures at the same time that targets for adopting scientific and technical achievements are being planned.

In settling the first issue, a well-known analogue can be used--the definition of second-rate goods. Those are goods which, in terms of indicators of technical level and quality, do not satisfy modern economic demands and are subject to be modernized or removed from production. Solving the second problem depends to a certain degreeeon the existing procedure of assessing the technical level and quality of machines, equipment, and other technology, and certification of these goods according to quality categories. This procedure stipulates that in the case of continuing to manufacture obsolete goods after the expiration of established deadlines, the decision is made to cease producing it or issuing orders for its delivery, and also to cease providing raw materials, energy, and supplies for manufacturing it.

Among the major aspects of enhancing the legal basis for adopting new technology, particular importance applies to complete adoption. Adopting the results of research and devleopment for inter-sector utilization is one of the most difficult tasks. The complexity of this is compounded by departmental scientific-technical narrowness which gives preference to satisfying its own sector's interests in the way of scientific-technical development. Everything which is external to that frequently takes second place or worse.

The legal basis cannot be confined to regulating problems of adoption on a merely local level, nor to examining them on the plane of eliminating obstacles only in the links between individual scientific and technical organizations, associations, and enterprises. Naturally, resolving these problems at that level requires working out legal forms of reciprocal coordination of the self-financing interests of each member participating in horizontal relationships. But htis is only part of it, for the need also arises to guarantee in vertical relationships a genuine correlation of the individual self-financing interests with the interests of the sector, and the sector's interests with the interests of the entire national economy.

The legal basis permits the coexistence of various forms and methods of organization adoption. Thus, science and industry are united by a substantial number of economic, organizational, legal, technological, and other sorts of ties. Among them, an especially important role is played by the ties deriving from plan targets. Program-goal-oriented planning is currently one of the most progressive methods underlying scientific-technical programs. Their power can become still more significant if a special statute is devised concerning the procedure of formulating and carrying out scientific-technical programs. It is important that this be a full-fledged normative act, rather than mere methodological instructions. Its basic goals should include the creation of a legal mechanism which would guarantee effective and a faster pace as well as programs a wider scale and higher level of technical and technological innovations. This legal mechanism should reinforce the focus on final results, comprehensiveness of program targets, and coordinating programs with the resources needed to realize them. It should provide an effective combination of sectorial and territorial scientific-technical planning, and regulate programs' administrative structure and the monitoring of their progress.

Among the economic methods of organizing the adoption of scientific-technical advances, the greatest hopes are placed on the self-financing system of efforts in the creation, assimilation, and adoption of new technology, based on agreements and commisions. The system passed approbation in the 70s and has been used since the beginning of the 80s in scientific and technical organizations, associations, and enterprises engaged in creating, assimilating, and adopting new technology in all sectors of industry.

Therefore, in our view, the proposition that enterprises and organizations in construction, transport, communication, and agriculture also be converted to this system deserves support. Furthermore, the individual elements of this system, in particular goal-oriented financing and the sources of forming funds for economic stimulation, can be used in the activities of academic institutes as well as institutes outside the production sphere, if their ties with the practical sphere are based on economic agreements.

FOOTNOTES

1. "Materialy XXVI S"yezda KPSS" [Materials of the 26th CPSU Congress], Moscow, Politizdat, 1981, p 43.

2. Ibid., p 43.

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MEANS FOR ACCELERATING SCIENTIFIC AND TECHNICAL PROGRESS OUTLINED

Moscow EKONOMIKA I MATEMATICHESKIYE METODY in Russian Vol 19 No 2, Feb 83 pp 321-327

[Article by G. A. Lakhtin: "Ways of Accelerating Scientific and Technical Progress"]

[Text] Comrade Yu. V. Andropov noted in a speech at the November (1982) Plenum of the CPSU Central Committee that large resources in the national economy "must be sought in the acceleration of scientific and technical progress and in extensive and rapid incorporation of the achievements of science and technology and advanced methods into production"; he further points out that it is necessary to uncover and eliminate "specific difficulties that interfere with scientific and technical progress. Planning methods and a system of material incentives should promote the union of science and production" [PRAVDA, 23 November 1982]. These directives lay the foundation of an entire program of action; they are aimed at perfecting the mechanism for managing scientific and technical progress, which will guarantee its acceleration. Therefore it is now suitable and advisable to work out some ideas of the principles behind the necessary improvements. The following points should be considered: the nature of the factors that are hindering scientific and technical progress, possible ways of planning a union of science and production, as well as incentive measures that would promote this union.

Scientific and technical progress is accumulating a huge number of major and minor innovations. In order to accelerate scientific and technical progress, it is necessary to: 1) intensify the influx of innovations and enlarge their scale as much as possible; 2) incorporate these innovations into production. The first step is provided by the activities of the industrial and academic sciences. The scientific potential that has been created in the country makes it possible to carry out a large volume of research and development. Realization of the results of this work is not always complete and often involves long delays. At the 26th CPSU Congress it was pointed out that it is necessary "to eliminate everything that makes the process of incorporating new developments difficult, slow and painful" ["Materialy XXVI S'yezda KPSS" (Materials on the 26th CPSU Congress), Moscow, Politizdat, 1981, p 43]. The problem of accelerating scientific and technical progress is primarily a problem of incorporation, of transforming a scientific result into a production result.

The fundamental reason causing the incorporation of scientific and technical innovations to remain as before the most critical area, is explained in comrade Yu. V. Andropov's speech: "In order to incorporate a new method or a new technique, it is necessary to reorganize production in one way or another, and this will have an effect on plan fulfillment" [PRAVDA, 23 November 1983]. These words reveal the fundamental principle of the difficulties involved in incorporation--an objective contradiction between two sides, two functions of contemporary production. On the one hand, it is aimed at manufacturing certain products with a given volume and quality. Steady output of products requires maximum production stability (technology, equipment, organization, flow of materials and so on). On the other hand, production must be constantly improved: products and technology must be renewed so they will remain up-to-date. In this role an enterprise becomes a participant in scientific and technical progress, the final link in the science-production chain, actively utilizing the results of developments. Every time something new is introduced, there is a break or a disruption in the established order. The one resists the other.

Thus the contemporary enterprise has two roles: a producer of standard products and a participant in scientific and technical progress. These functions must be seen as independent functions, since each has its own final result. The quantitative side is in opposition to the qualitative (which involves converting production to a new condition). This should be avoided when developing measures.

Under the present system of production planning (which developed during a period when changes in equipment and technology were only occasional), plans for production output and plans for incorporating scientific and technical achievements are disconnected. Incentives are also disconnected--prizes for plan quality indicators and for new technology are not coordinated. At the same time, production is unified, and both aspects (quality and quantity) serve one final goal--the maximum possible satisfaction of our society's demands. This requires a single mechanism that combines management of current production and management of scientific and technical development. This combination will result only if a plan is realized that organically unites production output goals with qualitative improvement of production. We will call this the principle of unified scientific, technical and production planning.

Management of current production output is oriented toward final, yield indicators, with the main factor being the quantity of production in natural or cost estimates. Discrepancies between the actual size of some indicator and the target (or planned) size are feedback signals which call into action some regulatory mechanism. This mechanism involves steps that eliminate the causes for the discrepancies.

In contrast to this, scientific and technical progress is not described by final, yield characteristics. A plan defines the entry effects: incorporation of some new technology, some new type of machinery. We must emphasize here the very important distinction between separate development (incorporation of a single innovation) and scientific and technical progress as an entire,

continuously on-going process, consisting of many independent developments. Each of them leads to definite results in production output (cost reduction, changes in the properties of the product, and so on). However, these separate results do not come together and there is no way to measure the flow of innovations (if you do not consider characteristics such as the proportion of production that is top quality, the flaws of which will be considered below).

Since there is no controllable yield parameter, there is no comparison between the planned result and the actual result, and there is no feedback mechanism. In terms of the production process, each planned incorporation of an innovation is a disruption at the entry stage that is not connected to achieving a specific indicator at the final stage. The number of measures taken for incorporating new technology says nothing about qualitative changes in production. An enterprise is not controlled by a plan quota establishing the final result of scientific and technical development; therefore an enterprise does not "chase after innovations".

Integration of the management of current production and scientific and technical progress is hindered by a fundamental difference in the mechanisms of management: current production is regulated by deviations from the plan, on the basis of feedback; scientific and technical progress operates by disruption, without any feedback. The former is significantly more effective since the feedback makes it possible to follow the results and respond quickly to deviations from the plan. Enterprises will not strive to incorporate innovations until they are forced to by final indicators.

This leads to the second principle: management of scientific and technical progress should be implemented with the aid of a feedback mechanism. Since this is an entirely different mechanism than what is now being used, it is impossible to make any substantial improvement in the management of scientific and technical progress by improving the existing system; there must be radical changes.

In order to introduce a feedback mechanism, an indicator is needed that can characterize the planned, as well as the actual, condition of production, in addition to gains that take place as a result of scientific and technical progress. Public demands long ago led to a search for a way to measure the results of scientific and technical progress. With the introduction of product certification came the indicator showing the proportion of production that is top quality. It is not suitable for the purpose under consideration because it has a number of flaws. In the first place, it reflects the merits of the products alone, and not the production process. In the second place, it is a nominal indicator, that is, it does not reflect the result of some measurement or evaluation, but the result of applying things to a certain category. Using this indicator, one can describe, for example, the fact that a certain number of products reached the boundary separating the highest category from the rest of the products; but it is impossible to plan or measure the improvements in the properties of the products over a five-year period, even though this is an indication of real progress. In the third place, it represents only a fraction, and not the whole. If some industry puts out 15 percent of its products with the Emblem of Quality, this tells us nothing about

the other 85 percent. And it is the remaining 85 percent that needs to be improved, and the efforts of the management organ should be directed at this sector. Generally, assigning goods to one of three categories is an indirect method that gives only rough evaluations which are insufficient for management purposes. We can compare this to trying to regulate thermal processes with no instrument for measuring the temperature; we use a scale with three intervals: "hot", "warm" and "cold". And scientific and technical progress is a much more complex object to manage; we need more precise measures. It is no accident that the "Basic Directions for Economic and Social Development in the USSR for 1981-1985 and for the period up to 1990" set as a task "improvement of the system for evaluating the technical and economic level of products that are developed and manufactured" ["Materialy XXVI S'yezda KPSS" op. cit. p 144].

The indicator should meet the following requirements: it should reflect the final results of scientific and technical progress; it should characterize both aspects--changes in the production process and in the product (so as to be all-encompassing); it should provide a quantitative measure of the progress achieved as a result of incorporating scientific and technical achievements; it should be the same for applied science, which creates the innovations, and production, which applies the results of the developments (in order to work as an instrument of unified scientific, technical and production planning, it must be able to serve as a reference point for both sides).

Gains made through scientific and technical progress can be expressed in two ways: in terms of the economic effect and the technical and economic level of production that is achieved. The first is the gain made by switching from one qualitative condition to another, for example, making use of some new technology. The economic effect characterizes only the process. A large effect can result by switching from a very bad process to one that is just bad or mediocre. What is important to society in the final analysis is the result, the new condition of production. In order to achieve this, developments are realized and difficulties are overcome on the path to incorporating the results. At the 26th CPSU Congress, the level of production quality was discussed in simple terms, "We cannot and should not settle for anything less than following the best world and domestic models" ["Materialy..." op. cit., p 43]. It was also emphasized persistently that it is necessary to economize in every way possible and to reduce production costs. The indicator which combines the characteristics of product quality and economy of production is the technical and economic level.

Public interest in this indicator has been steadily growing in recent years. Quite a few methods for measuring it have been proposed--there are apparently more than 100. It is not necessary now to specify which method should be used for calculating the technical and economic level. First we must establish a general condition that this indicator should be "graded" and should reflect the status that has been achieved, both in terms of the product and the production process. Therefore, a generalized interpretation is sufficient to start with, for example, "the technical and economic level of production includes a description of the quality of equipment being used, the organization of labor and production, as well as qualitative results tied to scientific and technical development. Thus this concept includes particularly technical

evaluations and economic indicators and serves as a distinctive synthesis of the technical and economic levels of production."*

Using the technical and economic level as a point of reference has another fundamental advantage over using economic effect. When determining the economic effect, the point of reference is the baseline, or obsolete technology, the equipment that is being replaced, yesterday's technology of production. If the technical and economic level is considered to be of the utmost importance, then by the same token, the starting point should be the prospects that lie ahead--the future condition of the products and production--the goals toward which we should be striving.

Thus, the third principle is that the leading indicator for following and managing scientific and technical development should be the technical and economic level.

The majority of the methods proposed in the literature for evaluating the technical and economic level do not go beyond the goal of evaluation. It is clear that the goal is not definition of the indicator, but management of the process, which in the given case involves obtaining a feedback signal on the results of scientific and technical development.

The concept of the "technical and economic level" itself includes some natural characteristics which are individual and not comparable. It is impossible, for example, using one set of parameters or another to compare different means of transportation, such as an airplane and an automobile. An airplane is not supposed to be able to overcome road obstacles and an automobile has no landing speed. The success of a particular development can be seen when there is a change in the parameters of a product or a reduction in its cost; but for evaluating overall results of scientific and technical development, that is, the flow of developments, this type of measurement is not suitable and a generalized measurement tool is needed. It must be universal and not limited to one specific type of product or industry. For example, an indicator showing the content of active substances in mineral fertilizer can be used to describe technical progress in fertilizer production, but it is not suitable for other types of production, even in the chemical industry. To fulfill the goals described above, we need a parameter which in principle can be used to measure progress in any industry; this parameter would be similar to the generalized indicators of gross or commodity output used in current production. This helps to define (in monetary terms) the volume of any production. A standard with the same degree of generalization is necessary for the scientific and technical development of production.

Universality is needed in another respect: the indicator should be able to be broken down (as gross output can be) and applied to an association, enterprise, shop, and so on; and the indicator should be able to be arrived at

*Budavey, V., "Regulirovaniye nauchno-tekhnicheskogo progressa" [Regulation of Scientific and Technical Progress], in VOPROSI EKONOMIKI, 1982, No 4 p 14.

by going in the other direction, from smaller units to larger ones, as well. Only under this condition can it serve as a common planning instrument.

In order to meet this demand for universality, the technical and economic level should not express any particular size or scale. In practice, this means the following. As was noted above, the technical and economic level synthesizes indicators of product quality and the production process. The quality of each separate type of product is evaluated with the help of references, which make it socially useful. For products designated for personal use, these are properties for the consumers (such as accuracy, durability and an hermetic seal in a wrist watch); for articles designated for use in production, these are technical parameters (speed, freight-carrying capacity of means of transportation; strength, workability and heat-resistance of building materials, and so on). Each of these references can have either an absolute or a relative measure. In the first case we are dealing with a set of parameters with numerical values that cannot be brought together because they are expressed in different terms--speed is measured in km/h, freight-carrying capacity in tons, and so on. In the second case, we define each parameter in terms of some standard and we obtain an index value that is independent of the original size. Proceeding from the general task of managing scientific and technical progress, which comes to attaining a world quality level, it is advisable to take this level as a standard and to compare to it all the values of actual parameters of products that are developed, introduced or produced.

Thus, the fourth principle is as follows: in order to serve as an instrument for planning and managing scientific and technical progress, the technical and economic level must be expressed as an index that is independent of size.

Identification of the standard level with the world level does not mean that it is essential to take the set of highest parameters found in the products of Western firms as the standard. For publicity purposes these parameters can be raised higher than the level that is economically advisable. In each case there exists a value for the quality indicator that is optimal and most profitable. This can be illustrated with the help of a simple model. We will assign to the x-axis the quantitative characteristics of a quality parameter (for example, the content of an admixture in a chemical, durability of of a material, accuracy of an instrument, and so on). We will assign costs, both rising and falling, to the y-axis. With an increase in the independent variable, there will be on the one hand an increase in the expenditures of the production unit, and on the other hand, there will be a decrease in the consumer's loss due to insufficient quality. For the common owner, who in this case is socialist society, the rubles in both parts are equal in value. Therefore we can add up the ordinates of these curves and draw the curve of total costs; the minimum point on this curve corresponds to the optimal level of quality.

In the majority of cases we are located to the left of this optimal point. Therefore we will not dwell on the degree to which the optimal level differs from the highest world level. Something else is important here: in every instance there is an idea of what level of quality has future prospects and can therefore be used as a standard. Since the planning mechanism always

"works" on a specific indicator, it is necessary for the reference that is chosen to reflect the essence of public demand.

The greatest difficulties are encountered in establishing standard values for the parameters. For totally new articles, it is not always clear which quality characteristics should be considered long-term and taken as reference points; but in the overwhelming majority of cases this difficulty does not arise. Of course, establishing valid standards requires collection and analysis of an immense amount of information, both foreign and domestic. It would be naive to think that it is possible to make serious changes in the mechanism for managing scientific and technical progress without making additional efforts and to achieve at no cost a positive effect at the national economic level.

Methods for measuring the technical and economic level can be described approximately as follows. For a given type of article (that is being evaluated), parameters are assigned which serve as consumers' references (that is, which define the social usefulness of the article); the actual size of the parameters is established. The values of these parameters as they correspond to the world level for the given article are established using technical and economic information and other sources or expert evaluations. By relating the actual indicators to standards it is possible to obtain specific index values, which when taken together define the technical level of the article. By averaging the separate parameters we obtain a numerical value which serves as a quantitative expression of the technical level. In order to go from this to the technical and economic level, the analogous operation is carried out for production costs. Here it is assumed that production costs serve as a generalized standard of the quality of the production process and its size reflects the quality of technology being used, the economic expenditure of raw materials and other materials, the organization of labor, and other production factors. The economic level includes the relationship between the actual production costs and the standard production costs. By multiplying the numerical values of the technical and economic levels, we obtain a single generalized indicator, the technical and economic level, which meets all the demands listed above. It can be broken down: knowing the technical and economic level of all the articles produced by a given enterprise, and the proportion of each in the total output, we can arrive easily at the technical and economic level of the enterprise (as a weighted-mean value); we can use an analogous process to go from enterprises to production associations, and so on. Because of this the indicator serves as a description of products, an enterprise, and an industry. In the opposite direction, it is possible to break down plan goals. The overall plan figure for increasing the technical and economic level over a five-year period can be broken down by a ministry and apportioned to associations, associations can do the same for enterprises, and so on all the way down to the level of different types of products. A comparison of the planned and actual sizes of the indicators will make it possible to control the course of scientific and technical development at all organizational levels and to management the development on the basis of a feedback system.

There may be some objections to the general nature of the indicator which makes it possible to use good technical parameters to compensate for excessively

high production costs, and vice versa, inadequate consumer properties can be justified by low production costs. In reality these two aspects are linked inseparably: production costs are what we pay for the properties, therefore in bringing together the quality and cost aspects we can either orient ourselves toward the combination of these factors that is optimal for society or we can use them separately. At the present stage it is important to establish the principle, and we need to assume that concrete methods for realizing it can be found.

New horizons are also opening up in the management of industrial science. The technical and economic level characterizes not only the qualitative condition of production. At the same time, it summarizes the activities of industrial scientific research and design organizations and experimental production. In planning an increase in the technical and economic level over a five-year period, the management organ should at the same time define at whose expense the planned progress will take place, and assign industrial science the task of preparing, on the basis of the existing projects in progress, the necessary changes in production. Industrial management will need to focus much more attention on thematic planning in the institutes under its jurisdiction and retain in their thematic plans only those projects which promise substantial advances in production. Instead of using questionable indicators such as "a given number of rubles' effect for each ruble spent", it will be possible to evaluate the activity of scientific research, planning and design organizations using the actual technical and economic level of the production operations being served and comparing it to the world standard.

Thus we can realize the principle of unified scientific, technical and production planning, the object of which should be quantitative output of products in combination with the technical and economic level of production. This principle reflects the fundamental proposition that society needs not only production, but production of a certain quality and cost. The unified plan is called upon to synthesize in one document the goals for quantity as well as quality of production, for changing the condition of production and for the scientific and technical developments which will bring about these changes.

Regardless of how the management mechanism is constructed, it will be put into practice by people, so a review of this mechanism would be incomplete without taking into account the incentives operating within it.

The opposition of the two aspects of contemporary production applies to incentives as well; there are separate incentives for fulfilling plans for current production output and plans for new technology. It should be noted that the majority of bonus payments are made for current production; incentives for assimilation of new technology account for only a few percent of the total bonus payments. Naturally under these conditions the incentive which offers the greatest reward per unit of effort applied will be the most effective. The weaker incentive is cancelled out by the action of the stronger one. The millions of rubles spent each year on bonuses for new technology are being used ineffectively, since the innovations would be implemented even without the incentives--this process takes place not as a result of incentives but through administrative pressure.

The mechanism described above for managing scientific and technical progress assigns a fundamental role to the planning and directive principle: the planning goals force an enterprise's directors to "chase after innovations". A common indicator should serve as a condition for common discipline and responsibility in terms of scientific and technical progress. This does not mean, however, that material incentives can be ignored. The planning principle will be strengthened substantially if incentives work in the same direction, and vice versa, it will be weakened if the material interests work in the opposite direction.

It is not realistic to increase payments for new technology so that they would exceed the effect of incentives paid for current production output, since this would require billions of rubles. Furthermore, this measure would hardly be effective because it would be easier to receive bonuses for stable work, just as before, when the alternative incentives are retained.

A solution can be found only by eliminating the opposition of the incentives. The one that corresponds to urgent social interests to the greatest degree is the one that should be retained. The other can be changed into a condition. This would mean abolishing bonuses for fulfilling production output plans and converting to bonus incentives only for final indicators of scientific and technical development under the condition that the plan for volume, products list and other quantitative indicators are fulfilled.

Therefore the fifth principle is that material incentives should be tied wholly to the results of qualitative development of production and should be separate from the quantitative side of production activity.

In practice, this means that an increase in the technical and economic level of products and production becomes the only reason for payment of bonuses. The size of the bonuses should depend on the real changes in the given production sector which are evident in the course of improvement: 1) in the production process; and 2) in the products. Thus it is advisable to develop a dual scale, where one of the measures is reduction in production costs and the other is a qualitative change in the products. The largest payments should correspond to attaining the world standard.

The social necessity for improving the management mechanism gives rise to the demands for developing the appropriate steps. It seems, however, that we should not suggest numerous detailed measures until the principles behind them have been worked out. The more valid and specific we can make these principles, the greater likelihood there is that the realization of the measures will be effective.

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DISCUSSION OF COOPERATION IN INVENTION MATTERS

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 1 Jan 83 pp 24-27

[Article by Igor' Chervyakov, director of the group for invention questions, CEMA Secretariat, in the column "Scientific and Technical Cooperation": "A Long-Range Program for Cooperation in Invention Questions"]

[Text] The congresses of fraternal communist and workers' parties in CEMA member countries have outlined broad programs for further increases in the efficiency of national production, improvement and deepening of socialist economic integration on the basis of the latest achievements of the scientific and technical revolution.

Successful realization of the Complex Program, long-range programs for cooperation, and multilateral agreements signed in their development, makes it possible to solve many important tasks of economic, scientific and technical cooperation, including those involved in inventions.

Following the adoption in 1971 of the Complex Program, invention activity has been increasing steadily in CEMA member countries: the number of applications for licenses and patents for inventions is increasing, as is the economic effect of their implementation. If 150,000 applications were submitted in CEMA member countries in 1971, in 1981 approximately 200,000 invention applications were submitted, or one-third more.

It is important to note the improvement in the quality of applications submitted: more and more technical solutions are being offered by inventions. In CEMA member countries in 1981 125,000 protection documents were submitted for inventions, including 1800 in Bulgaria, 1604 in Hungary, 7447 in the GDR, 64 in Cuba, 41 in Mongolia, 6102 in Poland, 2504 in Romania, 98,479 in the USSR and 7007 in the CSSR. Approximately 50,000 inventions are introduced every year in fraternal countries.

Activation of invention work has helped in further improving the technical level of machinery, equipment and manufacturing methods, as well as in making more economical use of fuel, power, production materials and raw materials. The economic effect in 1981 from introduction of inventions in Bulgaria, for example, was 86 million levs; in the GDR, it was 762 million marks; in the USSR, 2640 million rubles; in the CSSR, 1600 million korunas.

Between 1975 and 1980, joint activities in the area of inventions were conducted in accordance with the Measures for Cooperation among CEMA Member Countries in the Area of Inventions and Patents, which were approved together with the Basic Directions and Goals of Cooperation among CEMA Member Countries in the Area of Inventions and Patents, by the CEMA Executive Committee in October 1974. In practice, these measures have been completely fulfilled. With the aim of deepening cooperation among CEMA member countries and further activation of work in the given area, the Conference of Directors of Invention Departments of CEMA Member Countries developed a Long-Range Program for Cooperation among CEMA Member Countries in Invention Questions up to 1990 and Basic Measures for realizing this program. The CEMA Executive Committee took these documents under consideration at the 103rd session, keeping in mind that the Conference will be governed by them in their future activities.

The basic goal of the Long-Range Program is to create, systematically taking into account expansion of scientific, technical and economic ties, the best economic, legal and organizational conditions for the future development of inventions as one of the basic sources of technical progress and to carry out joint developments and research on a high scientific and technical level. Of primary importance is a significant decrease in the time between the creation of inventions and their realization.

Up to 1990, the primary attention of the Conference of Directors of Invention Departments will be concentrated on resolution of the following problems.

The Organization of Invention and Patent Work while Realizing the Goals of Long-Range Directed Programs for Cooperation

One of the most important directions of the activities of CEMA organs is realization of the Long-Range Directed Programs for Cooperation. In our opinion, it is essential when concluding agreements for realizing the measures of Long-Range Directed Programs for Cooperation to focus attention on questions of inventions and patent work. It is necessary to strive for a high scientific and technical level in the developments realized within the framework of the Long-Range Directed Programs for Cooperation; the latest scientific achievements and inventions should be utilized. The cooperating organizations should carry out the appropriate patent research, guarantee patent clarity, and as a rule, the patentability of the projects being developed. For efficient utilization of the results of scientific and technical cooperation in the export of production and sale of licenses, it is necessary to guarantee the legal protection of the inventions, the industrial models, and trade marks.

The Conference of Directors of Invention Departments is actively helping CEMA organs, and invention departments of CEMA member countries are providing methodological aid to ministries, departments and economic organizations of their countries for the realization of the measures of the Long-Range Directed Programs for Cooperation. They will continue to conduct special patent research and appraisal of applications for inventions created in the course of realizing the Long-Range Directed Programs for Cooperation and they will increase the amount of patent information provided to their countries' organizations by

making broader use of the services of the International System of Patent Information. The system for exchanging information on inventions that might be of use in the realization of Long-Range Directed Programs for Cooperation will be improved constantly.

Economics, Planning and Organization of Inventions

In accordance with the constantly developing and deepening ties among CEMA member countries in science, technology and production, the basic task of cooperation in the area of inventions is creation of the appropriate legal, economic, technical and organizational conditions for the most complete utilization of the creative potential that exists in the CEMA member countries, and directing it toward solving the fundamental national economic problems of CEMA member countries.

The basic prerequisites for improving cooperation among CEMA member countries in this area are development and deepening of cooperation in questions of planning the economics and organization of inventions. As is indicated in the Long-Range Program, it is necessary to improve jointly, taking into account the experience that has been accumulated, the systematic creation and introduction of fundamentally new, efficient technical solutions, to shorten the creation--realization cycle of inventions and other industrial property projects.

In order to achieve a unified approach in invention activities and to increase their efficiency, the Conference prepared a system for organizing and conducting invention work to be carried out by ministries, departments, associations and institutions in CEMA member countries when realizing intergovernmental and interdepartmental agreements on economic, scientific and technical cooperation, contracts, and so on.

Inventions, which serve as criteria for the level of new techniques and technology, are also at the same time means for achieving a higher degree of efficiency in developments. The long-range program provides for creation of methods which will make it possible to evaluate concretely and objectively results that have been obtained.

With the increase in the demands for quality and competitiveness in production, there is an increase in the role of industrial models. Development of methods for evaluating the positive effect of using industrial models will make it possible to increase their role in solving national economic problems.

Patent Information and Documentation

The fundamental task here is further development and improvement of the International System of Patent Information, with the aim of providing patent information to national users as well as to international organizations cooperating within the framework of CEMA, and especially those involved in the preparation and realization of measures of the Long-Range Directed Programs for Cooperation and other programs of CEMA member countries in the area of scientific and technical cooperation and production specialization and cooperation. The International System of Patent Information, as a specialized subsystem of the Inter-

national System of Scientific and Technical Information, solves these problems through the operational and directed transmission of patent information to organizations and enterprises of CEMA member countries in the process of creating new techniques, with an evaluation of the level of the new technical solutions and with the aim of avoiding unjustified duplication.

The long-range program indicates that for systematic development of the International System of Patent Information in accordance with the goals of cooperation among CEMA member countries on the basis of the Long-Range Directed Programs for Cooperation and other bilateral and multilateral programs of specialization and cooperation, it is necessary to realize cooperation on the basis of the predictions for development of the International System of Patent Information up to the year 2000, programs of development for the International System of Patent Information up to 1995, and the five-year coordinated plans for developing this system.

Improvement and development of the services of the system are inconceivable without expanded application of contemporary information carriers, including carriers that can be read by machine, and incorporation of new techniques and technology in the system. An important task is the complex automation of processing patent information using an electronic computer, which will help improve the efficiency with which the patent data store is utilized. Here it is important to ensure the compatibility of the national automated systems for processing patent information so that the results can be utilized widely throughout the International System of Patent Information.

Work on improving the system for exchanging information among CEMA member countries on the most important inventions is being continued. It should be noted that it has been carried out within the framework of the Conference for several years already. Invention departments are taking measures for broad and rapid dissemination of information in their countries on the most important inventions. In 1981 they exchanged 167 pieces of information on the 225 most important inventions. In 1981 the Council Secretariat prepared a collection of the most important inventions of CEMA member countries in the area of machine-building, which was compiled from data from Bulgaria, Hungary, the GDR, Poland, the USSR and CSSR; it contains 106 pieces of information on the 143 most important inventions.

Improving the Legal Foundations in the Area of Inventions and Other Industrial Property Projects

This is an important direction of the cooperation among CEMA member countries. It can be developed successfully by working out sound plans and concluding international agreements and regulations for their application, creating model provisions, analyzing the experience of CEMA member countries in the application of existing international agreements and other documents in the area of inventions and patent matters.

Assimilation and unification of legal norms in the area of inventions, facilitation and simplification of the process for obtaining legal protection for inventions, improvements in the legal foundations of economic, scientific and

technical cooperation--these are the main tasks in working out the multilateral agreement on a single protective document for inventions, the draft of which is still being worked on today within the bounds of the Conference of Directors of Invention Departments.

Of equal importance is the completion and signing of the Agreement on Mutual Legal Protection of Indications of Origin and Descriptions of the Places of Origin of Goods. This agreement will promote further development of economic cooperation among CEMA member countries and will make it possible to provide effective legal protection for indications of origin and descriptions of the places of origin of goods.

Work will be continued on legal protection of various industrial property projects, in particular new, special category projects, utilizing the experience that has been accumulated through the application of international agreements and other documents that are in effect in this area. First to be addressed should be those questions of economic and scientific and technical cooperation which involve assimilation and unification of legal norms for inventions in the countries concerned. Questions such as the criteria for how an invention can be protected, the range of projects that are protected, the period of operation and forms of protection for inventions, legal protection for inventions in chemistry, microbiology, medicine, nuclear physics, new types of plants, new breeds of animals, and so on, are pertinent here.

The long-range program provides for development of work in the CEMA member countries concerned in the area of organization of rationalization activity. There will be more extensive exchange of advanced methods and joint development of organizational, methodological, legal and economic materials. In particular the program stipulates creation of a provision on rationalization recommendations.

Appraisal of Applications for Inventions and Other Industrial Property Projects

One of the major goals of cooperation in the area of appraisal is improvement of the process of reviewing applications for inventions and other industrial property projects and providing high quality research and appraisal with the least labor and material costs. This is especially important in light of the growing quantity of technical solutions for which patent applications are made, including those that have been created jointly and mutually recognized documents for inventions that are in accordance with agreements made among CEMA member countries. Qualified and prompt appraisal of technical solutions that are submitted will promote stepped-up development and incorporation of new technology.

In order to create unified requirements for appraising applications for inventions and other industrial property projects, the Conference worked out the Methods for Appraising Applications for Inventions, which summarize the practices of state appraisal of inventions in our countries.

It is also very important to organize exchange of results of patent research when making appraisals; this will help reduce the volume of work required to make appraisals in the invention departments.

Training and Improvement of Skills of Personnel in the Area of Inventions and Patent Matters

The contemporary stage of scientific and technical development demands a qualitative increase in the level of training of management workers and specialists in the national economies of CEMA member countries in the area of inventions and patent work. This will be aided by measures involving development, by the countries concerned, of joint instructional materials and exchange of experience in the area of improving the skills of personnel.

The long-range program emphasizes that it is essential to continue work on developing and improving curricula for training and improvement of skills of personnel.

Providing Aid and Technical Assistance to Invention Departments of the Socialist Republic of Vietnam, the Republic of Cuba and the Mongolian People's Republic

One of the goals of CEMA is the promotion of accelerated economic and technical progress in CEMA member countries and gradual assimilation and equalization of the levels of economic development in these countries. In accordance with this, invention departments of CEMA member countries will continue to provide constant practical assistance to the invention departments of Vietnam, Cuba and Mongolia, that will help create conditions for more complete and rapid development of the activities of these departments on the basis of the experience offered by other CEMA member countries.

Cooperation with Third World Countries and Other International Organizations in Questions of Industrial Property

CEMA member countries are constantly improving cooperation with third world countries and international organizations in the area of protecting industrial property.

It seems advisable to work on a multilateral and bilateral basis to provide technical aid and assistance to developing countries in all questions of industrial property. An important task in connection with this is improvement, within the bounds of the Conference, of aid on the part of invention departments of CEMA member countries to developing countries for establishing an invention process. Joint activities of CEMA member countries for supporting the fair interests of developing countries in reviewing international agreements and contracts on industrial property should be coordinated at international conferences and meetings.

In order to develop international cooperation and increase the role of CEMA member countries in the area of protecting industrial property, the countries should participate more actively in the work of international organizations, primarily that of the World Intellectual Property Organization. It is essential to continue and develop cooperation between the CEMA Secretariat and the International Office of the World Intellectual Property Organization.

Thus the Long-Range Program for Cooperation among CEMA Member Countries in Invention Questions up to 1990 and the Basic Measures for its realization are the most important documents in the area of inventions and realization of these documents will make it possible to implement a number of integration measures directed at solving the numerous problems of economic, scientific and technical cooperation among countries of socialist cooperation.

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TRAINING AND IMPROVEMENT OF SKILLS OF SCIENTIFIC PERSONNEL DISCUSSED

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 2, Feb 83 pp 35-39

[Article by Professor Evgeniy Zhil'tsov, doctor of economic sciences, and Vladilen Andriyeshin of the CEMA Secretariat in the column "Scientific and Technical Cooperation": "Training and Improvement of Skills of Scientific Personnel"]

[Text] The Information and Methodology Base

In putting into practice the Complex Program, the CEMA Committee for Scientific and Technical Cooperation (KNTS) is constantly focusing attention on questions of cooperation among CEMA member countries in the area of training and improvement of skills of scientific personnel. The working organ of the committee is the permanent working group for cooperation among CEMA member countries in the area of training and improvement of skills of scientific personnel (the permanent working group on scientific personnel), which in fulfilling its decrees, carried out between 1976 and 1980 a significant amount of work in various directions in this area.

Today we can summarize some of the results. First of all we must note the efforts of the permanent working group in creating a series of informational and methodological materials, which serve as reliable references for all those participating in multilateral cooperation. Among these, we would like to point out especially the Handbook on Questions of Training and Improvement of Skills of Scientific Personnel in CEMA member countries; the Methodological Recommendations on Cooperation in the Area of Training and Improvement of Skills of Scientific Personnel and Scientific-Teaching Personnel, Organized by Councils under the Authority of Multilateral Agreements on Scientific and Technical Cooperation; the Suggestions for Improving the Effectiveness of Cooperation among CEMA Member Countries in the Area of Training and Improvement of Skills of Scientific Personnel and Scientific Teaching Personnel; Measures for Cooperation between the Permanent Working Group on Scientific Personnel of the CEMA Committee for Scientific and Technical Cooperation and the Permanent Commission of Scientific and Technical Societies of Socialist Countries, for Training and Improvement of Skills of Specialists; the Collection of Terms on Questions of Training and Improvement of Skills of Scientific Personnel; and the List of Specializations of Scientific Personnel in CEMA Member Countries.

In accord with the materials from the meeting of representatives of countries in the authorized councils and representatives of coordinating centers (in June 1981), the Handbook on Questions of Training and Improvement of Skills of Scientific Personnel in CEMA member countries, the Methodological Recommendations on Cooperation in the Area of Training and Improvement of Skills of Scientific Personnel and Scientific Teaching Personnel, and the List of Specializations of Scientific Personnel in CEMA Member Countries helped the authorized councils and the coordinating centers implement measures for cooperation among CEMA member countries in the area of training and improvement of skills of scientific personnel.

Within the bounds of the CEMA Committee for Scientific and Technical Cooperation, research was conducted between 1976 and 1980 on "Problems in Training, Improvement of Skills and Utilization of Scientific Personnel and Scientific Teaching Personnel". Developed as a result were the Methods for Determining the Demand for Specialists in Scientific Research Organizations, which make it possible to plan on a sounder basis the training of the personnel. Through joint efforts of the cooperating countries Methods for Evaluating the Working Qualities of Scientific Personnel were developed, which serve as a valuable instrument in the certification of scientific personnel. General information has been compiled, using the materials from the countries, on their participation in activities conducted by UNESCO and other international organizations in the area of training and improvement of skills of scientific personnel and scientific teaching personnel.

Over the past five years, eight international seminars of scholars and specialists from CEMA member countries have been held to exchange experiences and to present for approval by a broad scientific community the results of the work done on the themes mentioned above. Among these we can mention seminars on themes such as "Further Improvements in the Training and Improvement of Skills of Engineers and Scientific Personnel in Institutions of Higher Technical Education", "Problems in Determining the National Economic Demand for Scientific Personnel and Specialists", "Questions of Training and Improvement of Skills of Scientific Personnel and Scientific Teaching Personnel in the Area of Management".

According to the results of the seminars, scholars and specialists worked out suggestions and recommendations for scientific organizations carrying out research in accord with the plan approved by the Committee for Scientific and Technical Cooperation, the permanent working group on scientific personnel, and the corresponding national organs of the CEMA member countries.

Many of these recommendations have been utilized in practice by the countries concerned. In the People's Republic of Bulgaria and the CSSR they have helped in the development of principles for reforming higher education and in adding to laws on VUZ's; they have contributed to the development of activity in the area of training and improvement of skills of scientific personnel and scientific teaching personnel, and to strengthened reciprocal information activities among the national certification agencies of Bulgaria, Hungary, Cuba, the MPR, Poland, the USSR and CSSR.

Proceedings of the international seminars and monographs by collectives of scholars and specialists from CEMA member countries are published by the CEMA Secretariat and national departments and are distributed widely throughout the socialist countries, as well as in various international organizations. It should be noted that representatives of the UNESCO secretariat, developed capitalist countries and developing states have been invited to different seminars.

In addition to this, within the bounds of agreements on multilateral scientific and technical cooperation of CEMA member countries on the most important problems of science and technology (there are more than 100 such agreements), international symposia, conferences, seminars, summer and winter schools on various aspects of the development of science and technological progress are organized and include between 3500 and 4000 people.

Development of the Scientific Personnel Potential of CEMA Member Countries

Assigning great importance to questions of the formation and development of the scientific personnel potential of CEMA member countries, especially the highly skilled sector--doctors and candidates of science--the permanent working group prepared, and the Committee for Scientific and Technical Cooperation reviewed in 1976, a Plan for the Demands and Possibilities of CEMA Member Countries in the Area of Training Scientific Personnel and Scientific Teaching Personnel for 1976-1980, which formed the basis for cooperation in this area.

Table 1 shows data, for comparison, on the results of cooperation among CEMA member countries in training scientific personnel in graduate school and practicum experience from 1971-1975 and 1976-1980, as well as the planned data for 1981-1985.

Table 1 Training and Improvement of Skills of Scientific and Scientific Teaching Personnel in Graduate School and Practicum Experience in CEMA Member Countries (number of people)

	1971-1975[1]			1976-1980			1981-1985[3]		
Branch of Science	Total	Graduate Students	Practicum Students	Total	Grad. Stud.	Prac. Stud.[2]	Total	Grad. Stud.	Prac. Stud.
All sciences	11,871	2903	8968	9158	4398	4760	24,940	5315	19,625
Natural	1628	518	1110	1960	1090	870	3966	639	3327
Technical	2210	1202	1008	2505	1649	856	6991	1436	5555
Medical	137	62	75	568	328	240	1384	322	1062
Agricultural	401	179	222	739	429	310	2511	325	2186
Social	1774	704	1070	1570	902	668	5375	809	4926

[1]Data for Hungary and USSR not organized according to branch of science
[2]Data for Poland not organized according to branch of science
[3]Data for Cuba and MPR not organized according to branch of science

Between 1976 and 1980, 17,249 doctors of science and 160,190 candidates of science were trained in CEMA member countries (Table 2). This helped provide a substantial improvement in the quality of scientific personnel in socialist countries and strengthened their scientific and technical potential.

Table 2 Scientific Workers and Specialists in CEMA Member Countries who Received Academic Degrees of Doctor or Candidate of Science between 1976-1980 (number of people)

CEMA Member Country	Degree received in their own country			Degree received in another CEMA member country		
	Total	Doctor of Science	Candidate of Science	Total	Doctor of Science	Candidate of Science
Total	173,566	17,120	156,446	3873	129	3744
Bulgaria	2804	288	2516	875	29	846
Hungary	1988	347	1641	156	7	149
Vietnam	70	--	70	1218	26	1192
GDR	18,516	2831	15,685	292	5	287
Cuba	46	--	46	333	2	331
MPR		(no data)		270	26	244
Poland	21,677	2927	18,750	328	5	323
Romania		(no data)		28	--	28
USSR	120,153	10,209	109,944	157	11	146
CSSR	7775	513	7262	216	18	198

What has the work that has been done over the past five years on training highly skilled scientific personnel--doctors and candidates of science--including that done through cooperation with other CEMA member countries, brought to the different CEMA member countries?

In 1976 in Bulgaria there were 19,146 scientific workers, including 316 doctors of science and 5307 candidates of science. Here highly skilled scientific personnel accounted for about 30 percent of the total number of scientific workers. By 1981 the number of scientific workers in Bulgaria reached 22,601. Correspondingly, the number of doctors of science reached 645, and candidates of science, 7945, which represents 39 percent of all scientific workers.

We see from Table 2 that in the last five years, 288 scientific workers defended doctoral dissertations and 2516 defended candidate's dissertations in the academic councils of Bulgarian scientific research organizations and VUZ's, and 29 Bulgarian scientific workers were awarded academic degrees of doctor of science, and 846 the degree of candidate of science by academic councils of organizations in other CEMA member countries.

Table 3 shows data on the number of Bulgarian graduate students who were trained at home in their own country and abroad (primarily in CEMA member countries) during each year of the 1976-1980 five-year plan. It is clear from the table that in spite of the overall decrease in the number of graduate students in Bulgaria in connection with the fundamental resolution of the problem of pro-

viding the country with highly skilled scientific personnel, between one-third and one-half of the total number of graduate students from Bulgaria are being trained in other socialist countries. This applies primarily to graduate study in the contemporary specializations in which there are shortages of personnel (microelectronics, biophysics, powder metallurgy, robotics, etc.)

Table 3 Bulgarian Graduate Students Who Have Completed Graduate Study at Home and Abroad between 1976 and 1980

	1976		1977		1978		1979		1980	
Branch of Science	Home	Abroad	Home	Abroad	Home	Abroad	Home	Abroad	Home	Abroad
Total	2615	985	2282	860	1903	745	1589	632	1282	723
Natural	425	242	406	328	324	239	293	204	243	210
Technical	1405	373	1146	287	916	206	728	168	571	229
Medical	162	28	141	30	152	29	94	26	78	24
Agricultural	162	19	152	19	133	13	93	10	95	14
Social	461	323	437	286	378	258	381	224	295	246

In Poland in 1976 there were 69,686 scientific workers, including 8518 doctors of science and 18,612 candidates of science, which accounted for 40 percent of all scientific workers. As of 1 January 1981, the number of scientific workers in Poland reached 76,021, which included 9084 doctors of science and 24,983 candidates of science, 44.5 percent of the total. Over the past five years, 328 doctors and candidates of science from Poland have defended dissertations in CEMA member countries.

It should be especially emphasized that the countries of socialist cooperation that are more developed in terms of science and technology have provided significant assistance to Vietnam, Cuba and Mongolia in training highly skilled scientific personnel: between 1976 and 1980, 26 specialists from Vietnam defended doctoral dissertations in CEMA member countries, and 1192 defended candidate's dissertations; 2 specialists from Cuba defended doctoral dissertations and 331 defended candidate's dissertations; these figures were 26 and 244, respectively, from the MPR.

The increase in the number of candidates of science in Vietnam over the past five years was accomplished practically in full through training abroad. The majority of these highly skilled personnel in Cuba and the MPR was also trained on the basis of cooperation with CEMA member countries. The number of dissertations defended annually by specialists from CEMA member countries in other CEMA member countries grew from 564 in 1976 to 736 in 1980, which corresponds to the course for intensive development of science adopted by the countries.

Also of interest is a comparison of planned and actual indicators of the admission of graduate students from some CEMA member countries into the national training centers of other countries between 1976 and 1980. As Table 4 shows, on the whole almost 25% more students were admitted for graduate study than

was planned, with the actual figures for agricultural sciences higher by a factor of 2.19 and for medical sciences by a factor of 2.09. This substantial adjustment in the plans is tied to the need to increase the number of highly skilled specialists who will help solve the problems set forth by congresses of communist and workers' parties of CEMA member countries involving an increase in the production of foodstuffs and improved medical services for citizens of socialist societies.

Table 4 Graduate School Training of Scientific and Scientific Teaching Personnel (number of people)

Branch of Science	Total		1976		1977		1978		1979		1980	
	Plan	Admitted	Pl.	Admt.	Pl.	Admt.	Pl.	Admt.	Pl.	Admt.	Pl.	Admt.
Total	3576	4398	743	699	699	892	713	847	712	1011	709	949
Natural	860	1090	171	192	162	222	177	209	170	231	180	236
Technical	1486	1649	309	298	293	326	287	292	296	384	301	349
Medical	157	328	28	57	32	77	31	42	34	77	32	75
Agricultural	191	429	40	54	41	74	38	69	35	122	37	110
Social	882	902	195	98	171	193	180	235	177	197	159	179

As we have noted, a significant amount of work is being done to develop further and deepen the cooperation among CEMA member countries in the area of training and improvement of skills of scientific personnel and specialists within the framework of agreements on multilateral scientific and technical cooperation on the most important problems. Utilized here are forms existing on the national level, such as daytime and correspondence graduate study, practicum experience for workers and specialists, summer and winter schools, international conferences, symposia and seminars on the most urgent directions of the development of science and technology.

The materials from the meeting of representatives of countries in the academic councils and coordinating centers, held in June 1981 in the CEMA Secretariat, indicate that central scientific and technical organizations have assigned the academic councils and coordinating centers over 30 problems and they have the responsibility of organizing, with a certain frequency, specialized measures for improving the skills of scientific workers and specialists of the organizations participating in working out the corresponding problems.

This certainly helps to raise the scientific level and effectiveness of such measures. The academic councils and coordinating centers are working most actively on the problems: "Biological Physics", "Development of Theoretical Bases of Selection and Seed-Farming", "Study of the Chemical, Physical, Biological and Other Processes of the Most Important Regions of the World's Oceans", "Complex Utilization of Timber Raw Materials", and "Development of New Industrial Catalysts".

In the recommendations for improving the efficiency of multilateral cooperation among CEMA member countries in the training and improvement of skills of scientific and scientific teaching personnel, developed in 1976-1979, the permanent working group focused special attention on the need for training

highly skilled scientific personnel, first and foremost to conduct scientific research and planning and design work on the problems included in the Long-Range Directed Program for Cooperation, SPMIM [expansion unknown], as well as on the problems being solved by CEMA member countries on the basis of agreements on multilateral scientific and technical cooperation.

At the present time scientists and specialists from the USSR and CSSR, within the framework of the theme "Problems of Training, Improvement of Skills and Utilization of Scientific and Scientific Teaching Personnel", are completing the preparation of materials for evaluating the demand for scientific personnel needed for solving the scientific and technical problems included in the Long-Range Directed Program for Cooperation in Power, Fuel and Raw Materials. These methodological materials certainly will be useful also in determining the demand for scientific personnel in realizing other long-range directed programs for cooperation, SPMIM (in the area of science and technology), and in solving problems according to the agreements for international scientific and technical cooperation. Taking into account that according to the plans of the Committee for Scientific and Technical Cooperation and the CEMA permanent commissions, the predictions for the development of science and technology in CEMA member countries up to 1990 will be completed essentially in 1982-1983, the methodological materials described above will make it possible for the permanent working group on scientific personnel to create prompt, scientifically sound, long range (for 10-15 years) plans for cooperation among CEMA member countries in the training of scientific and scientific teaching personnel in the scientific specializations that are urgently needed.

In conclusion, we would like to note that in the last five years a definite information and methodological base has been created for multilateral cooperation among CEMA member countries in the area of training and improvement of skills of scientific and scientific teaching personnel, and multilateral cooperation has been combined actively with bilateral cooperation. As a result of the development and improvement of training of highly skilled scientific personnel on the national level, taking into account international experience, as well as on the basis of deepened cooperation among CEMA member countries in reciprocal training of these personnel, there has been a significant increase in the proportion of doctors and candidates of science in the total number of scientific workers. The permanent working group on scientific personnel has helped organize regular exchange of information materials among CEMA member countries, as well as advanced methods applied to questions of training, improved qualifications and certification of scientific and scientific teaching personnel.

The plan for the admission and direction of specialists from the CEMA member countries concerned into graduate study in other CEMA member countries for 1976-1980 has been exceeded.

It should also be noted that during these years there was significant underfulfillment in the exchange of practicum students among CEMA member countries, which can be explained to a considerable extent by the lack of regulation of financial and legal positions on expenditures and principles of organization of this work on the national level.

Taking into account the fact that between 1981 and 1985 the CEMA member countries concerned plan to exchange 20,000 practicum students, rapid resolution of this problem is an urgent and important task. It is also up to the working group to implement in CEMA member countries the List of Specializations of Scientific Personnel that it developed, with the aim of bringing the national lists together more closely.

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'VNESHTEKHNIKA' All-UNION ASSOCIATION DISCUSSED

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian
No 1, Jan 83 pp 52-54

[Article by Viktor Sinitsyn, candidate of technical sciences, Chairman of V/O [All-Union Association "Vneshtekhnika," under rubric "At Enterprises and Organizations of the CEMA Member Countries": "The Activities of V/O 'VNESHTEKHNIKA.'"]

[Text] In the system of economic relations that the USSR has with foreign countries, scientific-technical cooperation is becoming an increasingly important factor for accelerating the scientific-technical progress. The use of commercial forms is stipulated by the Comprehensive Program and the long-term target programs for cooperation. In the decisions of the CEMA Session (35th and 36th Meetings) it was recommended to the CEMA member countries that they continue to improve the scientific-technical cooperation and carry out the preferential development of cooperatives in the direction of the accelerated creation of advanced technological schemes, technology, and new materials on the basis of contracts. The need to develop production and scientific-technical cooperatives on a mutually advantageous basis was mentioned at the 26th CPSU Congress.

With the purpose of rendering assistance to Soviet organizations in the resolution of commercial, financial, legal, and other questions arising during the carrying out of scientific-technical cooperation with the organizations and companies of foreign countries, in 1967 the All-Union Association for Scientific-Technical Exchange with Foreign Countries -- V/O "Vneshtekhnika" -- was created.

The basic task of "Vneshtekhnika" is to render all kinds of assistance to increasing the economic effectiveness of scientific-technical cooperation with foreign countries by means of the expansion of commercial relations in that area.

During the past 15 years a large number of mutually advantageous contracts have been concluded and there has been a considerable expansion of the scope of the commercial operations being conducted and their geography. The association has partners in all the socialist countries.

"Vneshtekhnika" is an independent organization that is subordinate to the USSR State Committee for Science and Technology, and it operates on the principles of cost accountability and has full powers to conclude transactions with foreign contractors, representing the interests of Soviet scientific-research, construction planning and design organizations, and industrial enterprises on the foreign market.

The association's functions are extremely varied. In addition to commercial operations with its foreign partners for cooperative and ordered scientific-research, experimental-design projects (NIOKR), including experimental ones, it carries out the sale and purchase of the results of scientific-research projects, technical documentation, models of new technology, articles, and materials; it rents scientific equipment; carries out tests of new types of equipment, instruments, and materials of foreign production; renders technical aid and carries out technical-production instruction, translations of technical literature, and the purchase and sale of licenses that are linked with the transmission of the results of scientific-technical cooperation on the basis of the concluded contracts with the CEMA member countries.

Recently the basic type of activity for "Vneshtekhnika" has been the formation of cooperatives on the basis of contracts for scientific-research, experimental-design and experimental projects with the purpose of creating experimental models of machinery, equipment, instruments, new materials, and technological processes, which frequently include information of the "know-how" type, and sometimes inventions which can be the object of licenses.

It is here that one sees especially clearly the manifestation of the advantages of the application of contractual principles in scientific-technical cooperation: the substantial reduction of the financial and labor expenditures of the participating sides, as well as the periods of time necessary for the developments; the guarantee of the quality of the obtained results and their accelerated introduction into the national economy.

According to contracts, the association executes a number of large-scale and long-term projects both on a bilateral and multilateral basis.

Among the contract projects that have been carried out cooperatively on a bilateral basis, one should mention:

-- the joint development, by the Scientific-Research Center for Electronic Computer Technology (USSR) and the Scientific-Research Technical Center of the Robotron Combine (East Germany), of operational systems for the technical means of the YeS EBM [Unified System of Electronic Computers]; and the joint development, by the Central Scientific-Research Institute of Communications (USSR) and the Institute of Long-Distance Communications Technology (East Germany), of technological documentation for the production of a station for an integrational communication system with analogue-digital switching of the Unified Communication System;

-- the joint development, by organizations of the USSR Ministry of Power and East German organizations, of steel cells for nuclear electric-power stations, which make it possible to employ prefabricated designs;

-- the creation, by organizations of USSR Ministry of Ferrous Metallurgy and the Csepel Metallurgical Combine in Hungary, of highly productive technological equipment for the production of cold-deformed pipes made of carbon and stainless steels on flow lines;

-- the creation, by organizations of the USSR Ministry of Chemical Machine-Building jointly with the Main Administration of Air-Purification Plants in Czechoslovakia, of a unified electrical filter for the purification of technological gases, which is intended for application in the chemical industry with the purpose of protecting the environment against harmful industrial discharge and which guarantees a substantial increase in the percentage of the products that are caught.

Among the contract projects that have been carried out cooperatively on a multilateral basis, one can mention:

-- the joint development and tests of lead models of technological equipment and a technical plan for a standard technological line for the production of suspension polyvinyl chloride, with organizations of Bulgaria and East Germany;

-- the creation and introduction, jointly with organizations of East Germany and Czechoslovakia, of an effective technological scheme for the manufacture of supporting core insulators with tension of 110 kilovolts or higher;

-- the development, with the participation of organizations in Hungary and East Germany, of electromagnets for distributers with a short start-up time.

Contracts for ordered NIOKR have become widespread. For example, on orders from companies in the CEMA member countries, scientific-research and planning-and-investigative projects were fulfilled on a contract basis in the field of power engineering -- to develop effective measures for lightning protection of electrical transmission lines under tropical conditions for Vietnam.

Jointly with the Main Administration of Geodesy and Cartography, the association has been carrying out work to implement the agreements with the socialist countries for remote-control soundings of the earth from outer space and, on the basis of contracts, deciphered photographic materials from space surveys are being transmitted to those countries.

For the Rohrkombinat People's Enterprise in the city of Riesa (East Germany), VNIImetmash, of USSR Ministry of Heavy Machine-Building, has developed a technological scheme and has manufactured an experimental machine tool for the continuous cold rolling of pipes. That manine tool has a number of substantial advantages: it makes it possible to save energy and metal, and increases the productivity of the rolling process.

On order from Bulgarian organizations for TETs [heat and electric-power plants] in the cities of Vrattsa and Burgas, The "Soyuzpromgaz" All-Union Scientific-Production Association (USSR) is developing combined devices for boiler units.

In turn, on orders from Soviet organizations, foreign companies have been developing technological processes and technical documentation for the manufacture of various kinds of equipment.

For example, on order from the USSR Ministry of Heavy Machine-Building, the East German Ministry of the Mining, Metallurgical, and Potassium Industry is preparing and will transmit the technical and working plans for furnaces for electron-ray smelting.

In the examples that were cited, the effectiveness was expressed in the providing of the branches with new equipment and modern technological systems, in the increase in the mechanization and automation of production and in labor productivity, and in the considerable reduction in the amount of time required for the development and introduction of new machines, instruments, materials, and technological processes. All this contributes to the resolution of the key task of the fraternal countries -- the raising of the technical level of production, and its quality indicators.

It has been broadly practiced, along the "Vneshtekhnika" line, to manufacture and transmit, in accordance with work orders of Soviet and foreign organizations and companies, the results of the national scientific developments and technical documentation for the latest industrial equipment, transportation means, construction machinery, and machines, machine tools, and instruments, and modern technological schemes.

The obtained scientific-technical results can be used during the carrying out of one's own research, with the customers being granted the right to produce output in conformity with the obtained documents and to sell that output on the territory stipulated by the contract.

The association annually concludes contracts for the purchase and sale of scientific-technical documentation.

This kind of mutual exchange actively promotes the acceleration of scientific-technical progress, since the use of the obtained documentation makes it possible to save time and one's own labor and material resources for developing it.

An example of the transferral of technical documentation is provided by the following documentation:

-- for an automated system for controlling enterprises with multiple product lists and for a navigational radar station, for organizations in Bulgaria;

-- for a unit to purify industrial runoffs by the pressure-flotation method -- for Hungary;

-- for the production of a diesel locomotive engine, type 4H21/21 and for an automated system for controlling the production of the Lvov television receivers -- for East Germany;

-- for the designing and construction of VP electrical transmission lines with tension of 750 kilovolts -- for Czechoslovakia.

In turn, Soviet organizations received from East Germany, Czechoslovakia, and other countries valuable documentation, including documents for ship boilers, telephone exchanges, mining equipment, electronic automatic trainers, small offset machines, medical apparatus, etc.

In 1981 the USSR delivered to the socialist countries models of various kinds of scientific equipment: instruments and equipment for computer technology; crystallization and holographic units; quantum generators; various measurement devices; seismoacoustic apparatus; etc.

During the same period, USSR organizations received from the socialist countries models of equipment for scientific laboratories; instruments for microfilming, and copying machines; chromatographs; automatic recording devices; and electromeasurement apparatus.

The sale and purchase of one-of-a-kind scientific equipment and the instruments necessary for conducting research in various fields of science and technology constitute a considerable volume of commercial transactions in this area.

For example, the association has concluded a contract for delivery to Poland of a one-of-a-kind extra-eclipse coronograph for the observatory at Wroclaw University. A contract for the delivery to Bulgaria of an experimental-production model for the automatic regulation of water distribution in an irrigation system is being fulfilled.

In accordance with orders from foreign organizations, "Vneshtekhnika" sends out highly qualified Soviet specialists, who render methodological and practical assistance to scientific-research and planning-and-designing organizations, enterprises, institutions of higher learning, and schools. They also carry out a considerable amount of work to train the national cadres and to develop science, culture, public health, and sport.

The largest number of Soviet specialists are sent to render technical assistance on problems of electric-power engineering, machine-building, metal-working, construction, transportation, shipbuilding, and the administration of production.

In conformity with intergovernmental agreements, the countries in the socialist community send to the Soviet Union specialists for technical-production training. They are sent to attend production refresher courses, and they attend instructional courses at enterprises and institutions in the USSR. In addition, consultative sessions on individual problems of science and technology are conducted for them.

The association executes orders from Soviet organizations for the rendering to them of technical assistance on the part of foreign specialists in the fulfillment of such services as the reading of radio and television announcements, translations, editing, etc.

Soviet specialists, in turn, are sent to the socialist countries for technical-production instruction.

On a contract basis "Vneshtekhnika" grants services to foreign companies and Soviet organizations for the testing of scientific and technical innovations.

The Soviet Union is a major importer of machinery, equipment, and materials, a tremendous quantity of which appears annually on the foreign-trade market. The

evaluation of their suitability for the Soviet consumer is determined by means of tests under the appropriate production and climatic conditions of the USSR. They are carried out by Soviet scientific-research institutes, laboratories, and industrial enterprises with the participation of highly qualified specialists and representatives of foreign companies and organizations on the basis of coordinated programs. For example, dump trucks (produced in Czechoslovakia), means of computer technology (East Germany), and electrical equipment (Hungary) have been tested.

In addition, "Vneshtekhnika" concludes contracts for the testing of scientific and technical innovations that have been developed by Soviet organizations and that are intended for shipment to the socialist countries.

The 26th CPSU Congress advanced the task of developing direct ties among the ministries, associations, and enterprises of the fraternal countries.

The association's role is growing significantly as a result of the planned conversion, by the end of 1983, to a contract basis of the scientific-technical cooperation among the branch ministries, associations, enterprises, and organizations of the USSR with the corresponding departments and economic and production units in the other CEMA member countries.

As a consequence there has been a substantial increase in the volume of contract operations that are linked with the implementation of the contracts (agreements) dealing with scientific-technical coperation, with operations involving the exchange of models, the purchase and sale of licenses, and with the transferral of the obtained results to the CEMA member countries. "Vneshtekhnika" carries out activities of this type in accordance with assignments from the USSR ministries and departments.

There has been a considerable change in the content and direction of the contract operations. At the present time the basic attention is devoted to the concentration of efforts on the priority directions of scientific-technical cooperation which have been defined by the Comprehensive Program, the DTsPS [long-range target programs for cooperation], and the SPMIM, and to the guaranteeing of the fulfillment of the pledges by the contracting parties, and the increasing of the effectiveness of cooperation.

It is planned that the subject matter of the contracts will create a scientific-technical backlog for the production of energy-, materials-, and labor-saving technology and technological schemes, and means of automating and mechanizing production.

All this contributes to the fulfillment of the tasks posed by the CEMA Session for improving the interrelationships of scientific-technical cooperation with production specialization and cooperation, and with the questions of implementing the jointly created output, and for intensifying the coordination among all the links in the "science-technology-production-sales" cycle.

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NARO-FOMINSK SYMPOSIUM ON ACCELERATING SCIENTIFIC-TECHNICAL PROGRESS

Moscow EKONOMICHESKIYE NAUKI in Russian No 2, Feb 83 pp 122-123

[Article by Candidate of Economic Sciences A. Vakar under the heading "Scientific Life": "Economic Problems of Scientific-Technical Progress"]

[Text] In May, 1982, the USSR AS [Academy of Sciences] Scientific Council for Economic Problems of Scientific-Technical Progress (STP) and the "Znaniye" society Scientific-Methods Council to Propagandize CPSU Economic Policy and Economic Theory organized and held in Naro-Fominsk (Moscow Oblast) a symposium devoted to the economic problems of accelerating STP in developed socialist society. Participating in it were party and state workers, VUZ instructors, scientific research institute scientists and propagandists.

Doctor of Economic Sciences L. I. Abalkin (Academy of Social Sciences attached to the CPSU Central Committee) gave a report on "Several Pressing Problems of Improving the Economic Mechanism At the Present Stage." In reference to the tasks of economic theory and practice concerning implementation of the resolutions of the 26th CPSU Congress, the speaker examined the problems of perfecting the economic mechanism. In particular, it was noted that its quality must be evaluated in terms of the state of the economy. It should be recognized, L. I. Abalkin continued, that one of the basic causes of difficulties in economic growth is the inadequacy of the economic mechanism to modern conditions (such as the scale and complexity of the economy, the orientation towards quality parameters, and others). In the speaker's opinion, one substantial shortcoming of today's economic mechanism is the management of the economy by elements (STP, quality, capital investment). The economic mechanism should be viewed as a unified whole; in particular, there should be no special mechanism for managing STP. The present stage of improvement in the economic mechanism, the report stressed, is an objectively necessary stage in establishing an economic mechanism adequate to the economy of developed socialism. The task consists in fully implementing the program for improving the economic mechanism which is contained in the CPSU Central Committee and USSR Council of Ministers decree of 12 July 1979.

In revealing the current status of the STP management system, Doctor of Economic Sciences K. I. Taksir (USSR AS Institute of Economics) touched in his report, "Pressing Problems of Perfecting the Management of Scientific-Technical Progress," on its most substantial shortcomings: lack of a single STP management center, intensification of the departmental approach to introducing new

equipment, increasing capital investments designated for equipment repair, and others. All this, the speaker noted, could not but lead to a number of negative phenomena (an unnecessarily high proportion of obsolete fixed production assets, a narrowing of the experimental base, innefective use of certain types of raw and other materials). The situation which has evolved, K. I. Taksir thinks, cannot be corrected by isolated improvements in the area of STP management; to do this, we need comprehensive measures. In particular, the creation of target comprehensive programs (for example, programs aimed at lowering the consumption of natural raw material for production needs) is very important. In the future, other measures associated in considerable measure with improving the organization of economic activity at any level will also be required. The speaker cited as such measures, in particular, restructuring and strengthening the design base in machinebuilding branches, foremost those of Group B; developing the contractor method of introducing new equipment through the creation of specialized state organizations; perfecting planning and incentives in scientific-production associations. The speaker expressed the opinion that it was necessary to create an interdepartmental council on STP problems and in the future, a combined section for planning STP in the five-year state plan, which must be balanced in terms of all types of resources.

Doctor of Economic Sciences V. D. Kamayev (Moscow Higher Technical School imeni N. E. Bauman), Honored Scientist of the RSFSR, gave a report on "Several Problems of National Economic Growth in the 1980's." The speaker considers the theory of economic growth to be one of the pressing problems of political economy which has not, unfortunately, attracted the attention of researchers. The report stressed that the present stage of development cannot be described only from the position of the factors which have evolved: first, because they are not unanticipated, and second, because objective analysis demands consideration of all factors, including those accelerating economic development (growing economic potential and scientific-technical opportunities, high general educational level of the aggregate workforce, economic integration, and others). In the speaker's opinion, one complex problem of economic growth is its evaluation. Obviously, a quantitative approach is clearly inadequate; we need an analysis of qualitative development. Such an approach presupposes refinement of a number of questions which have for long seemed indisputable, in particular, concepts of the direct dependence of accumulation fund size on high rates of growth in national income.

In the lively discussion which developed after the report, quite a few interesting ideas were expressed and a number of statements of principle were worked out.

Doctor of Economic Sciences N. A. Klimov (Institute of World Economics and International Relations) touched on several STP problems in the developed capitalist countries. The material base of STP in these countries, he said, has turned out to be very narrow for the "reindustrialization" about which so much has been said recently and for which the time is really at hand. Hence, the searches aimed at further improving STP management. In spite of frequent assertions that "the pendulum of state regulation" of economic development in general and STP in particular "has swung too far," there are no grounds for thinking, in the speaker's opinion, that capitalism will return to the regulation tools of the early 20th century. The predominant trend in recent years has been to reduce the level of state financing in many forms and to simultaneously increase the

centralization of decision-making processes in the area of STP on the basis of increasingly precisely outlined comprehensive goals.

Doctor of Economic Sciences G. D. Lebedev (Academy of Social Sciences attached to the CPSU Central Committee) defined scientific-technical progress as a multi-strata economic category. In its most general form, it can be characterized as an enormous objective social force of production whose basic substrate is universal embodied (scientific) labor. Modern STP qualitatively enriches the entire system of knowledge and creates prerequisites for changing over to a new level of development of the communist method of production.

The speech by Doctor of Economic Sciences G. Ya. Kiperman (Scientific Research Institute of Planning and Standards attached to the USSR Gosplan) was devoted to two problems -- improving the system of planning indicators and strengthening ties between economic theory and administrative practice. In the speaker's view, work on improving the physical indicators of products and heightening their role in planning and evaluating the activity of production links need not lead to a reduction in the role of cost indicators. Effective use of cost forms and categories in the interests of obtaining the best end results with the lowest expenditures is a pressing scientific and practical task. Physical indicators must not be set in opposition to cost indicators. Speaking about the tie between theory and practice, G. Ya. Kiperman noted in particular that more attention is paid to criticism than to positive proposals in many scientific developments.

Doctor of Economic Sciences V. I. Torbin (Scientific Research Institute of Prices, USSR State Price Committee) spoke on the importance of cost forms for the economic stimulation of STP acceleration. He touched on the role of prices in creating a cost-accounting interest in producing new and highly effective output. The basic directions for perfecting the specific mechanism whereby they influence the release of such output were revealed in the course of the last wholesale price review. In particular, the speaker showed the importance of widening the practice of using the system of surcharges and discounts for product quality and differentiating profitability levels on the basis of product interchangeability.

Candidate of Economic Sciences V. I. Kushlin (Social Sciences Academy of the CPSU Central Committee) focused attention on the necessity for careful economic evaluation of the rates of scientific-technical progress. Given limited capital investments, balance in the rates of introduction of interlinked scientific-technical innovations is especially important. The speaker demonstrated the urgency and ways of solving this problem in the example of pressing tasks of improving the balance of modernizing the production apparatus in industry.

Candidate of Economic Sciences V. G. Moskovskaya (Moscow Higher Technical School imeni N. E. Bauman) examined STP content as an internal element of socialist production. She posed the question of defining the place of STP in the system of socialist production relations. A number of talks examined the influence of STP on the level of production collectivization. In the opinion of Candidate of Economic Sciences N. M. Svidan (Moscow Institute of Steel and Alloys), the transformation of a number of external ties of various branches into internal ties of an APK [agroindustrial complex] system is one of the consequences of this influence.

In the opinion of V. V. Pavlov (Moscow Institute of the National Economy imeni G. V. Plekhanov), the indicated influence intensifies the role of the time factor in economic processes and growth in the intensiveness of structural changes in the national economy. The importance of developing the economic mechanism whereby fundamental, revolutionary achievements of science are actualized was stressed by Candidate of Economic Sciences V. P. Groshev (Academy of Social Sciences attached to the CPSU Central Committee). We need to "inventory" all STP achievements and shape special strategy programs for actualizing effective scientific conclusions.

The talk by G. N. Khabalov (Academy of Social Sciences attached to the CPSU Central Committee) was devoted to questions of choosing and implementing highly effective inventions and scientific discoveries; he proposed several methods approaches to the economic evaluation of scientific results.

A number of speeches spoke of the necessity of combining regional and branch approaches to the problem of accelerating STP. Thus, in the opinion of V. T. Gurenko (Academy of Social Sciences attached to the CPSU Central Committee), a methodological apparatus should be developed for combining in an optimum manner regional and branch interests in accelerating STP. The speech by Candidate of Economic Sciences V. L. Kvint (Institute of Economics, USSR Academy of Sciences) was devoted to an analysis of experience and problems in the theoretical substantiation of processes of developing and implementing major regional STP programs. Speaking of the work being done in this country to prepare a "USSR Comprehensive STP Program for 1981-1990," he stressed that the economic mechanism for coordinating the branch and territorial cross-sections of this program has not heretofore had the necessary methods basis.

Candidate of Economic Sciences V. V. Gorlopanov (Moscow Higher Technical School imeni N. E. Bauman) touched on problems of the organizational structure of management and production under STP conditions. He focused particular attention on factors resulting in changes in them: increasing complexity of the production-technical and organizational ties of enterprises, less time for developing and mastering the production of new output, an expanded assortment of output being produced. The basic trends in developing the socialist production structure under the impact of a rising level of collectivization were examined.

Candidate of Economic Sciences B. A. Myasoyedov ("Ekonomika" Izd-vo) spoke on the publishing house's work last year and its future plans.

Doctor of Economic Sciences Ye. F. Borisov (All-Union Correspondence Law Institute) spoke of the necessity of raising the level of propagandizing the achievements of economic science. The meaning and importance of the informational, scientific and practical potentials of lectures on economic topics were revealed in this connection. The speaker touched on the importance of a lecturer's mastery not only of the art of public speaking, but also of pedagogical and psychological skills necessary to ensure effective contact with the audience and better effectiveness of propaganda talks.

In conclusion, L. I. Abalkin noted that a fruitful exchange of opinions permits illuminating the pivotal problems of improving the organization of economic activity at various levels of STP actualization and the development of a number

of proposals which are of important significance to the practical resolution of the tasks of accelerating scientific and technical progress.

It was decided to publish the materials from the symposium.

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ROUNDTABLE DISCUSSION OF DOSTANKO ARTICLE

Minsk KOMMUNIST BELORUSSII in Russian No 1, Jan 83 pp 62-69

[Article under the heading "At A KOMMUNIST BELORUSSII Roundtable": "'Prerequisites of Advanced Technology'"]

[Text] The number 3 issue of our magazine for 1982 published an article by Professor and Doctor of Technical Sciences A. P. Dostanko, department head at Minsk Radio Engineering Institute, under that heading. It raised a number of problems associated with introducing advanced technology in the decisive branches of industry and training corresponding personnel. The questions posed in the article were the subjects of discussion at a "roundtable" meeting organized by the machinebuilding department of the Belorussian Communist Party Central Committee and the editorial staff of KOMMUNIST BELORUSSII. Participating in the discussion were V. F. Kondratenko, deputy head of the machinebuilding department of the Belorussian Communist Party Central Committee, and A. N. Sushko, a department instructor, P. V. Yanus, chief of the Belorussian republic Gosstandart [State Committee for Standards] administration, I. Ya. Poletilo, general director of the Minsk Machine Tool Manufacturing Association imeni October Revolution, the following technologists -- G. F. Groshev ("Gomsel'mash" association), O. A. Medvedev (Minsk Production Association imeni V. I. Lenin), B. S. Kosobutskiy ("Gorizont" association), V. L. Shaytanov ("Termoplast" plant), Yu. F. Lyashuk (Precision Electronics Machinebuilding Design Bureau) -- I. S. Kobel', deputy chief engineer of the 11th GPZ [state bearing plant], Zh. A. Mrochek, deputy director of the Belorussian SSR Academy of Sciences FTI (Physicotechnical Institute), V. N. Zdakevich, deputy director of the Minsk Planning-Design Technological Institute of the USSR Ministry of Tractor and Agricultural Machinebuilding, and Professor A. P. Dostanko.

Important Element of Production. Economy and a thrift-oriented attitude towards the national wealth is currently a question of the feasibility of our plans, Comrade Yu. V. Andropov, CPSU Central Committee General Secretary, said at the November (1982) CPSU Central Committee Plenum. These words apply in full to problems of introducing into industrial production modern technological

processes -- highly productive, low-waste or entirely waste-free ones permitting saving a maximum of material, labor and energy resources. It would not be an exaggeration to say that the level of technology is one of the most capacious indicators of scientific-technical progress in any branch of our economy. It is precisely this level, as the most flexible component of production, which currently determines opportunities for intensifying the economy and improving its efficiency, which leads to genuinely revolutionary transformations in industry and calls to life the new means of labor which ensure these transformations.

The discussion participants stressed that this problem has a second important aspect, the social aspect, as well. Advanced technology creates conditions for perfecting the character and content of people's labor and for its intellectualization, and it leads to radical change in the role of man in the productive forces system. The way to this is opened up by reducing the share of monotonous, low-productivity operations, which are being taken on increasingly widely by the automated machine tools, complexes and sectors, robot-manipulators, and so on, which are being introduced into production. It is precisely advanced technology which makes feasible the task set by the 26th CPSU Congress of effecting a changeover to the large-scale use of highly effective machine systems and technological processes which ensure comprehensive production mechanization and automation and the retooling of its decisive branches.

Experience convinces us that progressive technology lives considerably longer than the machines and items manufactured using it. By dint of its flexibility, it can be adapted to changing designs. And when the opportunities for increasing the quantitative parameters through design improvements turn out to have been exhausted, it is precisely technology which provides an opportunity to make a qualitative spurt forward.

At the same time, until recently, the approach to ensuring product quality has been somewhat different: design developments were evaluated without consideration of technology. In other words, we reviewed what had been done but did not analyze in detail how it had been achieved.

"We have been certifying output with the Badge of Quality for 15 years now," said P. V. Yanus. "The proportion of output in the highest category is what has interested us. The attention of both the State Standards Committee and the Gosplan has been focused on this. And when the Belorussian Communist Party Central Committee posed the question of how high quality was being achieved, we more clearly understood the concept we were approaching. We had in fact been focusing our attention in recent years on producing the primary types of output which would ensure technical progress in the national economy. We had earnestly approached evaluating design resolutions from the viewpoint of the competitiveness and reliability of the machines, of meeting the requirements of the standards and other parameters. The Belorussian Communist Party Central Committee induced us to take the next step, to change over to evaluating another most important factor ensuring high quality -- technology. It is time to change over to certifying technological processes, to learn to determine whether they guarantee a high level of output.

Specialists understand that lag in technological developments is born largely of inadequate attention to this problem on the part of administrative and planning

agencies. This is to be explained by the fact that the development and introduction of new technology is a laborious process sometimes requiring considerable expenditures and even new construction. As a result, we speak of hundreds of new items being mastered each year by republic industry, but there are at best only dozens of fundamentally new technological processes, sometimes less than 10. So-called "primitive mercantilism" comes into play -- better to save a ruble today than to receive 10 tomorrow. The figures bear this out: where fundamental changes have occurred in technology, in radio-electronics industry in particular, the proportion of output net cost reduction in the economic impact of raising the technical level of production is almost 10 times higher than in branches where the technology has essentially not been improved.

But we at the least need initial normative documents to change views on the role and place of technology, and a fruitful step in this direction has been made in the republic. The council of chief technologists (comprised of specialists from the largest enterprises in the branch) attached to the Belorussian Communist Party Central Committee's machinebuilding department, jointly with the Belorussian republic State Standards Committee administration, has worked out "Recommendations on Certifying Basic Production Technological Processes at Republic Industrial Enterprises," which have been approved by the BSSR Council of Ministers Commission on Scientific-Technical Progress Questions and the USSR State Standards Committee.

"This document, which is acceptable to everyone," P. V. Yanus remarked, "has become a kind of landmark indicating how to determine the primary links on which the quality parameters of the end product depend; it should be introduced first of all within the framework of the target programs of enterprises and entire branches. We are convinced that product certification is not an end in itself, but a means enabling us to see what exactly is retarding quality growth at any given enterprise. And not only to see it, but to plan specific ways of eliminating shortcomings.

Let's say problems arise with new equipment reliability at the "Gomsel'mash"; this means we should first reveal the factors limiting this parameter. There is, for example, a big spread in castings and forgings characteristics at the BelAZ: certification enables us to reveal the causes.

In order to ensure that application of the recommendations worked out is feasible, the BSSR State Standards Committee is creating oblast consultation centers for technological process certification and has set up contacts with corresponding Belorussian Communist Party obkom departments.

Incidentally, it is quite clear that recommendations alone, even the most detailed and well-substantiated, are not enough. In order to certify new technological processes, we need at a minimum to have such recommendations. But both objective and subjective difficulties of an administrative and, more often, organizational nature stand in the way of advanced technology.

"Practically every machine currently includes old technology," said G. F. Groshev. "Not one plant, technologist or chief engineer takes the risk of introducing new processes at the moment an item's production is being mastered.

The changeover to advanced technology clearly takes time and possibly even involves a temporary reduction in the rates of production volume growth. True, a sharp leap forward may then follow. But the old saying "better one in the hand than two in the bush" [better a titmouse in the hand than a crane in the sky] persists.

Enterprises naturally have certain difficulties with raw and other material supplies which delay the introduction of technological innovations. For example, as I. S. Kobel' said, bearings with plastic retainers have been developed at the No 11 GPZ, and it is feasible to produce six times as many as are being made now. But the appropriate raw material is not being supplied the plant, and we continue to be preyed on by scarce aluminum alloy blanks. We have developed new technology for pressing rollers which promises a savings of 400 tons of metal per year and have installed equipment costing two million rubles, but here, too, underdeveloped supply organizations have turned out to be an impediment.

"Little attention is currently being paid to procurement operations," added G. F. Groshev, "while technology, figuratively speaking, actually encompasses all processes, 'gate to gate' -- from receipt of the raw material to shipment of the finished product. The State Standards Committee should turn its attention to the fact that the existing GOST [All-Union State Standards] for cold stampings and castings provide metallurgists with a carefree life. Hence, mountains of shavings. I guess one of the most important questions today is that of perfecting the technology of procurement operations. This would open up broad opportunities for automating basic production.

And the discussion participants focused attention on one other important problem. Equipment arriving at an enterprise often fails to meet the demands of new technology.

"These reproaches are largely justified," agreed I. Ya. Poletilo. "True, we are behaving differently with one type of equipment -- balancing, in that we try to 'sell' new technology and the machinery designed to implement it, specifically. This is a step forward of sorts, but not a guarantee that the methods we propose are best. Machine tool manufacturers are also not in a position to make each item with consideration of the technology of particular 'buyers'. What is the way out? Scientific institutions must, in my view, concentrate their attention on developing standard technological processes which can be recommended to a broad range of enterprises, including machine tool manufacturers. We could then be able to take them into account when developing new equipment models. Judge for yourselves what this promises. There are 40,000 different parts at our production facility. In order to make each in accordance with a GOST, we would need to have 500 technologists, whereas we actually have more than four times fewer, and they are not able to keep track of everything. But the development of standard processes would also permit a reduction in the demand for specialists and more confidence in ensuring high quality in end products.

This idea was warmly supported by all discussion participants, who noted that the active enlistment of science in the development of standard progressive technologies would in many instances enable us to make things for ourselves

rather than buying them abroad. We should determine base enterprises, fundamental and branch scientific research institutes and VUZ's which would be responsible for particular technological directions. Moreover, science must also accept orders from production. Only thus can we achieve a qualitative advance and not trust solely in the ideas of efficiency specialists which, although useful, still do not contain fundamental innovations, but rather simply improve what has already been made.

Road to and Support of the Search. Without a doubt, quite a bit has been done to strengthen the interaction of science and production, especially in the last 5-10 years. Still, when possible, enterprises have up until now tried to get by on their own, without the help of scientists.

"We are doing quite a bit of economic-agreement work with scientific institutions," remarks B. S. Kosobutskiy, "but our interests often do not coincide, especially in terms of schedules. Institutes ordinarily require 2-5 years to develop a particular problem, but at the plant, the cycle for preparing new technology must not exceed 14 months. So we generally work with those who agree to our conditions.

And if an agreement is not reached? Then the enterprise "stews in its own juice," so to speak. For example, the "Gomsel'mash" created two lines [of research] in the association technology laboratory, along with two corresponding groups of specialists. One deals with active quality control problems: it develops devices and equips machine tools with them. The second, after studying the experience of the ZIL and GAZ [motor vehicle plants], is introducing manipulators, that is, reworking to its own requirements commercially produced robots, "teaching" them, and interfacing them with equipment. This is helping create automated lines based on the use of ordinary multipurpose machine tools.

But can factory science fully replace so to speak "professional" science?

"Of course not," Zh. A. Mrochek agrees. "We do need standard processes, but those who are engaged in this and are developing the corresponding equipment must be fully occupied with this, not working 'for oneself'. Otherwise, the innovation will be loss-producing and will unavoidably 'wither away', as they say.

In the scientist's opinion, the experience of the BSSR Academy of Sciences FTI testifies to the fact, given the thorough development of technological processes at scientific institutions, it is possible in many instances to even do without their subsequent certification. Thus, before working out a particular technological process at a plant (and creating an equipment prototype), the institute would make a detailed economic calculating taking into account the savings in metal and energy resources, improvement in quality and reduction in labor intensiveness. The plant approves the calculations. And only if the work is advantageous to the enterprise would the scientists take up the matter.

"But we can fill an order," continues Zh. A. Mrochek, "only after demanding of the plant with which the economic agreement is being concluded the metal, equipment and assembly components, because we cannot buy all that ourselves with the funds being allocated industry under the agreement. And even if we find it is

possible to acquire them, more than one year is needed to actualize this possibility. In the meantime, technology moves forward, and we again find ourselves behind.

What is the solution? Scientists justifiably think the developer of a technology must also create the first equipment prototypes for it. So OK, the FTI does have its own design-technological bureau and prototype production facility, and these subdivisions work very productively with the institute. Suffice it to say that in 1982 alone, Finland, Italy and Australia acquired licenses for three of this collective's developments. About a thousand of the country's collectives have sent work requests to scientists, but they usually want to receive both the new technology and the equipment needed for it, made on a "turnkey" basis, that is, ready for operation when the first start-up button is pushed. The institute is not in a position to do this.

It was pointed out at the 19th Belorussian Communist Party Central Committee Plenum (1979), as applicable to the BSSR Academy of Sciences FTI in particular, that the time has come to create experimental plants at certain institutes to produce finished series of appropriate equipment and to create scientific-technical associations on this base. But this is, so to speak, an organizational factor which has unfortunately yet to be resolved. Moreover, there are quite a few "reefs" of a purely economic nature in the path of introducing scientific achievements. For example, taking deductions to economic incentives funds into account (at those scientific research institutes which have them), it is two to three times more advantageous to scientists to carry out dozens of small projects involving 50,000 rubles of savings each than one development with an impact of half a million rubles. And so it happens that science often "patches the small holes" in current production and sets aside major problems capable of making literally revolutionary changes in technology.

The economic mechanism of interaction among scientific-technical organizations at different levels has still not been properly adjusted. If a development by a scientific research institute is transferred not directly to a plant, but to a branch planning-design organization, there is most often no mention of the scientists in the plan created as a result of this, much less any recognition of their contribution to the economic impact obtained. Such is, unfortunately, often the case in the experience of many institutes of the BSSR Academy of Sciences.

At the same time, as the discussion participants emphasized, the development of fundamentally new technologies is no longer possible without thorough research, without including fundamental and branch scientific research institutes, VUZ's, planning-design organizations and the plants themselves in a "single harness." Let it even be on a healthy, competitive basis. There is a firm document foundation for ensuring this. The decree adopted by the CPSU Central Committee and USSR Council of Ministers "On Steps to Improve the Work Effectiveness of Scientific Organizations and Accelerate Use of the Achievements of Science and Technology in the National Economy" orients us towards creating qualitatively new technological processes which ensure a several-fold increase in labor productivity as compared with the existing level. The demands of this document are strict and precise: "With a view towards ensuring extensive competition in the field of scientific-technical developments, averting the rise of a monopoly in solving

the most important scientific and technical problems and ensuring that the most effective ways of solving them will be chosen...[we are] directed when necessary to do investigative scientific research, as well as planning, design and technological development, using several organizations going different routes in order that the best scientific, technical and economic decisions can be made ...in the early stages."

It is important that both union and republic levels have the right to issue such instructions. In other words, there is a basis for organizational decisions en route to creating new technologies. Factors of an economic nature remain. The general path to regulating them was clearly indicated at the November (1982) CPSU Central Committee Plenum: "It is necessary that those who boldly move to introduce new equipment not turn out to be at a disadvantage."

Technology Needs Technologists. No proof is required for the fact that, in an era of scientific-technical revolution, the specialist has become the decisive figure in production, especially in introducing new technology, and the demands on his skills are constantly growing. In our republic, as in the country as a whole, a great deal is being done to meet industry's personnel needs. An important role is being given to the technical VUZ's, which generally represent broad-base scientific collectives capable of research at the junction of different fields, that is, in the most promising fields of contemporary knowledge. A talented young person entering a VUZ is actively accustomed to this search and, when he leaves the student lecture halls, is armed with a psychological readiness for active creative labor, along with his engineering diploma. Unfortunately, these potential possibilities often remain unrealized.

True, many enterprises participate in training future specialists and clearly formulate their requirements of them. Thus, the production association imeni V. I. Lenin had requested engineers in a certain specialty and the Minsk Radio Engineering Institute immediately adjusted the appropriate study courses. But things have unfortunately not gone any farther than that.

"Industry participates poorly in preparing highly skilled technological personnel," remarks Professor A. P. Dostanko. "Suffice it to say that only one doctor of sciences and about 15 candidates of sciences are working in republic radio-electronics industry. Plants raraly send the institutes aspirants to scientific degrees and graduate studies and are quick to remove them. But in fact, the technical level of the enterprises of these branches in the republic provides fertile soil for training highly skilled specialists. In order to use this opportunity, it seems to me, we should plan for enterprises to train such personnel and make them answerable for failure to carry out those assignments.

A truly paradoxical situation is developing: a plant spends funds on attracting a competitor or its "own" graduate student to creative work. And then he is "degreed" and might work at a higher level of skill, bringing to technical resolutions the knowledge obtained in the course of preparing a dissertation. But plant leaders release this person, with an easy heart, as the saying goes, to a scientific research institute or for teaching work. Thus, seven specialists defended candidate dissertations in recent years at the No 11 GPZ. Six have left the plant.

Incidentally, VUZ's alone do not exhaust the opportunities for improving the skills of technologist personnel. There are other ways as well. One is to create at the plants groups of young people around experienced technologists, mentioned by G. F. Groshev. Another, pointed out by Zh. A. Mrochek, is to send plant technologists to those scientific research institutes and experienced production facilities where new technology and equipment for it are being prepared for the enterprise. But these and several other opportunities are hardly being used at all. Why?

"The sad fact is," states B. S. Kosobutskiy, "that enterprise technological services were 'lost' 10-15 years ago: their importance was underestimated. And now the technologist has been converted to some sort of walking encyclopaedia, a 'scapegoat' for all production sins. If something is not just so with the normatives, processes, technical assignments or materials, the technologist is to blame. He is required to know state and branch standards, every conceivable technical specification, equipment safety instructions, and so on, and so forth -- in a word, anything you like...except technology.

Great hopes have been placed on the "Unified System of Technological Documentation" (USTD), conceived with a computer base. But the problem is that, while the USTD exists, the computers usually do not. The volume of documentation is growing sharply, but technologists continue to process it manually.

"Even when there is computer equipment," I. Ya. Poletilo remarks, "it requires software for the machine to be considered technology based on standard processes. That is when an enormous impact can be expected from the USTD.

The long years of inattention to technology, and, incidentally, to the occupation of technologist as well, have caused a reduction in interest among young people in it. What personnel are currently most in short supply, both in industry and in other branches of the national economy? Technologists.

"It is hard for an enterprise to increase its cadres of highly skilled technologists," reflects I. S. Kobel'. "Even were he to be a Solomon, a young specialist would need more than five years to become a category I technologist; moreover, professional growth does not entail equivalent material interest. This is why, whereas about 10 years ago young people were trying to get into the technical departments, they now strain to get into the shops, inasmuch as effective steps were taken to heighten the role of the foreman in production and increase the payment for his labor.

There is an objective cause here, and it was pointed out long ago by K. Marx. He wrote that science, as a product of mental labor, is always appraised far below its value because the working time needed to reproduce it is incomparable to the working time required to produce it initially (see K. Marx and F. Engels, "Soch." [Works], Vol 26, Part I, p 355).

But even this does not justify the fact stated at the "roundtable" by O. A. Medvedev: the wage of a technologist lags considerably behind that of a designer who is equally skilled. For instance, in machinebuilding and several other branches, the pay of a category I technologist is equal to that of a category II designer, that of a category II technologist -- that of a category III designer,

and so on. In such a situation, is it easy to staff technological services with truly highly skilled specialists?

Also unsolved are problems of the training and wages of mid-level technical personnel, which are made much more difficult by the use of finished technological "tools", machine tools with numerical perset control, industrial robots and automated complexes in particular.

Of course, as was stressed during the "roundtable" meeting, many problems connected with the sharp rise in the level of technology and the increased role and prestige of the technological services (which is also of considerable importance), cannot be solved instantly. But it is also impermissible to put them off endlessly "for later": if we do not take up the broad transformation of technology, foremost in machinebuilding, today, immediately, then it will unavoidably lag behind the rates of technical progress tomorrow.

The 9th Belorussian Communist Party Central Committee Plenum pointed out that the question of using as fully as possible every opportunity and reserve for economizing has now taken on special meaning. The production growth rates planned for 1983 must be provided with a comparatively smaller increase in material expenditures and labor resources.

It is precisely progressive technology which will basically ensure that the maximum impact will be attained with the least expenditures possible. It now plays the most important role in improving our industry. And it can be brought to the forefront of scientific-technical progress and ensure radical production transformations and qualitative development of productive forces only through the joint efforts of enterprises and academy, branch and VUZ science.

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BSSR ACADEMY OF SCIENCES TIES WITH PRODUCTION

Minsk PROMYSHLENNOST' BELORUSSII in Russian No 1, Jan 83 pp 39-42

[Article by Doctor of Technical Sciences and Professor I. Glazkov, USSR State Prize winner, under the heading "Alliance of Science and Production": "Shoulder to Shoulder"]

> [Text] The greatness of our homeland and the might of its economic and scientific-technical potential are a result of the strenuous creative labor of the Soviet people, of all the nations and nationalities of the USSR. Laborers of the Belorussian SSR, along with those of other republics, are making a worthy contribution to developing the economy, science and culture of the Nation of Soviets.

Republic scientific collectives have accumulated considerable experience in solving a number of major theoretical and practical problems, testimony to which is the awarding of BSSR Academy of Sciences scientists two Lenin and two State Prizes of the USSR in the 10th Five-Year Plan. Our scientists are credited with three registered major discoveries and about 7,500 certificates of invention. Last five-year plan, the level of expenditures to finance scientific institutions of the BSSR Academy of Sciences, ministries and departments increased 33 percent. The amount of work done by BSSR Academy of Sciences institutes and republic VUZ's under economic agreements with enterprises increased 73 percent and was 53.8 million rubles in 1980. The 10th Five-Year Plan work volume was completed under 66 union scientific-technical programs, 60 republic scientific-technical programs and programs for introducing scientific developments into production. The economic impact of introducing BSSR Academy of Sciences and republic ministry and department developments into production in the 10th Five-Year Plan was double the 1971-1975 level, 890 million rubles, including 264 million rubles in 1980, 135 million rubles of which was accounted for by BSSR Academy of Sciences developments.

The BSSR Academy of Sciences is one of the country's largest scientific centers. Five of its divisions combine 32 scientific institutions, including 28 institutes. We continue to develop the experimental-prototype base of science. In the 10th Five-Year Plan, 195 million rubles was directed into the republic for these purposes, including about 34 million rubles to strengthen the base of academy science.

At the present stage, when the development of science and engineering must be subordinated even more to the resolution of economic and social tasks, the intelligent, effective use of scientific potential, further development of urgent scientific research and extensive introduction of its results into the national economy have acquired top-priority importance. The policy of increasing the effectiveness with which scientific-technical potential is used has provided an opportunity for accelerated development of such new branches of industry in the republic as machinebuilding, chemical, petrochemical, radio-electronics and others. The machine tools, tractors, automobiles, appliances, furniture, refrigerators, watches, electrical equipment, radio and electronics items being produced at Belorussian enterprises are famous far beyond republic borders and many are in demand abroad.

How the scope and national economic significance of the scientific research done in the BSSR have grown year by year can be traced in the example of the republic Academy of Sciences. Its subdivisions currently operate in nearly every oblast center. Thus, Gomel' has the Institute of Metal-Polymer Systems Mechanics and a division of the BSSR Academy of Sciences Mathematics Institute, Mogilev -- divisions of the physics institute and physicotechnical institute, Vitebsk -- a division of the Institute of Solid-State and Semiconductor Physics, Grodno -- an independent department of metabolism regulation. All this facilitates bringing science closer to the concrete needs and demands of the national economy.

Questions of improving reciprocal ties between science and production, and especially the development of those forms which fully correspond to the new organizational structure of production and the accelerated introduction of innovations, are of important significance in the acceleration of scientific and technical progress. The reference is to changing over from the technological specialization of scientific-technical organizations relative to phases of the "research - production" process to program-thematic topical specialization relative to fields of science and engineering or scientific-production cycles.

The most progressive and effective form of integrating science and production, and one which has been further developed in our republic, is the scientific-production association, within whose framework scientific research and experimental-design development are done and the industrial release of new items is organized. Today, there are 197 production and scientific-production associations here.

Work programs permitting a comprehensive approach to solving the most important scientific-technical problems of developing the national economy, scientific-technical associations operating on a voluntary basis, and so on, are important means of improving the interaction of scientific institutions, branch institutes and production enterprises. The most widespread forms of establishing contacts between scientific institutions and production remain the economic agreements on scientific-technical cooperation. During the 10th Five-Year Plan alone, their level rose 2.2-fold, to 36 million rubles in 1980, which comprised 53.7 percent of all scientific research financing.

A majority of the agreements concluded are aimed at developing new equipment and technology at the invention level and are of great national economic significance. Economic-agreement relations have now become the basic form of ties between

science and production. Quite a few examples could be given of solutions being found to very important scientific-technical problems of production branches of the national economy within the framework of economic-agreement relations with scientific-research and experimental-design organizations of the BSSR Academy of Sciences on the basis of fundamental research.

Thus, a number of defended author's certificates on new methods permitting simplification and reduction in the cost of the technological process for producing semiconductor devices, improvement in their quality and a significant increase in the percentage output of usable item were developed on the basis of fundamental research done at the BSSR Academy of Sciences Institute of Solid-State and Semiconductor Physics. The methods proposed were made the basis of technology for producing pulse diodes, diode matrices, thyristors, transistors and integrated microcircuits. The new technology has undergone successful prototype commercial testing at a number of enterprises in the country. The economic impact of its use in industry during 1978-1980 was about four million rubles. We thus resolved an important national economic task connected with increasing the percentage output of usable semiconductor devices and integrated microcircuits and improving their quality and reliability.

In the coming five-year period, scientific institutions of the BSSR Academy of Sciences intend to conclude more trilateral "academy institute - branch institute - industrial enterprise" agreements and agreements in which republic VUZ's participate. It seems appropriate to change over from concluding individual economic agreements to financing new interbranch production facilities working on BSSR Academy of Sciences developments. On the one hand, such production facilities would be a powerful base for further developing and improving new equipment and technology, and on the other, they could satisfy the requirements of the branches of the national economy concerned.

Planned cooperation with ministries, departments and large production associations has been put onto a scientific basis. An analysis of the state of affairs provides grounds for asserting that the organization of such cooperation and monitoring progress in carrying out joint scientific-technical plans on the part of the BSSR Academy of Sciences Presidium, ministry collegia and association leaders enables us to conclude economic agreements which exclude the element of chance. The system of economic-agreement relations is becoming more purposeful, more subordinate to the basic directions of scientific-technical progress development in all branches of the national economy.

The BSSR Academy of Sciences Institute of Solid-State and Semiconductor Physics is cooperating fruitfully with enterprises of the USSR Ministry of Machine Tool Manufacturing. For example, a super-hard material created as a result of long research has been introduced at many branch plants. The overall economic impact exceeds 25 million rubles.

The Institute of Machine Reliability and Durability Problems is working on developments aimed at forecasting and seeking ways to improve the reliability and durability of metal-cutting equipment. In particular, it is cooperating with the Vitebsk Machine Tool Manufacturing Plant imeni S. M. Kirov, the Vitebsk Sharpening Machine Plant, the Orsha "Krasnyy borets" machine tool manufacturing plant, the Gomel' Machine Tool Manufacturing Plant imeni S. M. Kirov and "Gidroavromatika" production association, and the Minsk Machine Tool Production

Association. In 1976-1980, the collective at this institute worked out and introduced at enterprises of the USSR Ministry of Machine Tool Manufacturing Industry 20 developments with an overall economic impact of about three million rubles.

In many instances, cooperation between institutions of the BSSR Academy of Sciences and enterprises of the USSR Ministry of Machine Tool Manufacturing Industry has been done under republic scientific-technical programs and work programs to develop and introduce new equipment and technology.

Scientific-research and experimental-design work in the field of powder metallurgy has received considerable development in the Belorussian SSR Academy of Sciences in recent years. A Republic Scientific-Technical Center for Strain-Hardening Technology has been formed, with the basic task of developing and widely introducing new technological processes and specialized equipment for strain-hardening parts and machines using powder methods. Included in it are the Physicotechnical Institute, the institute of machine reliability and durability problems, physics institute and institute of applied physics of the BSSR Academy of Sciences, the Belorussian Republic Scientific-Production Association of Powder Metallurgy, Minsk Planning-Design Technological Institute of the USSR Ministry of Tractor and Agricultural Machinebuilding, the "BelavtoMAZ" and "Minsk Tractor Plant imeni V. I. Lenin" production associations, and the planning-technological institute and "Remdetal'" plant of the State Sel'khoztekhnika Committee. The BSSR Academy of Sciences Physicotechnical Institute was designated the lead organization. In the 11th Five-Year Plan, the center's work will be done under a scientific-technical program in whose implementation 70 organizations from 28 of the country's ministries and departments will participate. This program anticipates the creation of a broad network of industrial-prototype sectors for strain-hardening machine parts, the development of about 100 prototype and industrial-prototype installations and pieces of specialized equipment and 27 new technological processes. The anticipated economic impact of implementing the program assignments is more than 20 million rubles.

The Belorussian Academy of Sciences is one of the first in the country to use the new organizational form of ties between academy and production organizations -- the voluntary scientific-production association. Such an association is basically formed by several academy institutes and an industrial enterprise. It is run organizationally and methodologically by both the enterprise and the Academy of Sciences. Our republic already has five scientific-production associations operating on a voluntary basis, including the Minsk Tractor Plant and institutes of the BSSR Academy of Sciences Department of Physicotechnical Sciences, institutions of the BSSR Academy of Sciences and Gomel' enterprises (the "Gidroavtomatika" and "Gomsel'mash" production associations, machine tool manufacturing plants) and others. The creation of voluntary associations together with the lead enterprises of branches of industry facilitates the introduction of final developments and ensures that the development of fundamental and applied research will be planned in connection with the problems of long-range branch development.

Scientists of the BSSR Academy of Sciences are always searching for new organizational and economic resolutions which will ensure the integration of scientific and production activity, acceleration of the process of introducing the

results of scientific-technical achievements into the national economy. Thus, one of the qualitatively new organizational forms has been the combining of fundamental research with planning-design and experimental-prototype production within the framework of academy scientific-technical complexes (ASTC). Their basic task (the complexes include an academy institute, design bureau and experimental production facility) is the rapid and high-quality development, on the basis of scientific research results of design or technological developments, and manufacture of a prototype and its transfer to industrial enterprises. There are eight such complexes in the BSSR Academy of Sciences system. It should be noted that the ASTC has a number of features in common with the scientific-production associations. Here, as in the SPA's, the lead organization is the scientific research institute. ASTC's already account for about 60 percent of the works being introduced by the BSSR Academy of Sciences and more than half their economic impact.

One other organizational form of ties between science and production, the dual-subordination subdivision (laboratory), whose basic task it is to accelerate the introduction of academy institute scientific research results at the enterprises concerned, is also worthy of recommendation. Experience in operating dual-subordination subdivisions has been approved by the 29th Belorussian Communist Party Congress as a promising form of integration of science and production.

The effective use of various forms of ties between science and production has had a positive effect on lessening the time involved in introducing completed BSSR Academy of Sciences institutions' scientific research into the national economy. Thus, about 1,200 works with an overall economic impact of 345 million rubles were introduced during the 10th Five-Year Plan, which is more than three times as much as the analogous indicator for the 9th Five-Year Plan.

The increasingly complex structure of the economy, the development of economic ties, continued differentiation of the management system, and the increasing orientation of economic activity towards end results have caused an expansion of the target-program approach. Target-program planning and management first of all facilitate ensuring the priority of national economic interests and block departmental and localistic tendencies and orient us towards a comprehensive approach to using resources and achieving the best results. Second, conditions are created for a broad unfolding of local initiative; purposefulness, flexibility and responsiveness of management in all links are heightened; the rights, opportunities and duties of the basic economic cells are broadened. I am pleased to note that the BSSR Academy of Sciences was one of the first to have disseminated the target-program methods of planning to fundamental research by approving 20 programs in the natural and social sciences.

Sixty comprehensive programs were carried out in our republic in the 10th Five-Year Plan. As a result of their implementation, 70 percent of the total increment in labor productivity in industry was obtained, the equivalent of freeing 150,000 people for other work. An additional 500 million rubles in profit was received. The Belorussian SSR participated in carrying out 66 programs associated with solving the country's most important scientific-technical problems within the framework of a social division of labor.

Fifty republic scientific-technical programs and assignments under 75 union programs will be carried out in the 11th Five-Year Plan. For the first time, we are planning the implementation of seven republic target comprehensive scientific-technical programs.

The considerable purposeful work being done by the republic party organization to implement party and government resolutions in the area of developing science should be particularly emphasized. The Central Committee of the Belorussian Communist Party and the republic government are striving for its results to be used most fully and effectively to resolve nationwide tasks. Party organizations, in guiding the work of scientific collectives, are focusing the attention of scientists on choosing the most effective paths of scientific-technical search and concentrating their efforts on solving those cardinal national economic problems to whose actualization a weighty contribution by science is vitally necessary. The work by Belorussian scientists in the fields of algebra and differential equations, optics and spectroscopy, radio- and microelectronics, materials technology, heat- and mass-exchange, the physiology of the autonomic nervous system, genetics and linguistics, is particularly well-known. Fundamentally new devices, technological installations and processes have been developed and introduced into the national economy on the basis of fundamental research results.

Achieving an organic combining of the achievements of the scientific-technical revolution with the advantages of the socialist economic system is a task of top-priority importance. One important condition of its actualization is coordinating and consolidating the efforts of not one, but several union republics. This demand stems from the complexity and scope of the tasks of our economy, science and engineering, whose resolution is possible only through the joint efforts of many of the country's scientific centers.

Successful fundamental and applied research is being done on a number of common regional problems by associates of the Belorussian, Ukrainian and Moldavian academies of sciences. For example, the BSSR Academy of Sciences Institute of Heat- and Mass-Exchange, the UkSSR Academy of Sciences Institute of Heat Engineering, the MSSR Academy of Sciences Institute of Applied Physics, and the Kiev and Kishinev polytechnical institutes are working on the scientific-technical problem of using heat- and mass-exchange in technological processes. Scientific recommendations are being used at the Cherkass and Severodonetskiy "Azot" production associations, the Sverdlovsk Building Materials Plant, the Minsk Gypsum Plant, the Leninabad and Riga silk combines, and the Gor'kiy and Moscow motor vehicle plants. A total of eight scientific research institutes, five production associations, six combines, and 17 plants and factories have been enlisted in resolving and introducing new developments on this topic. As a result, important results have been achieved: new methods of treating industrial wastes have been proposed, and coagulation installations for treating wastewater have been developed and are already in operation at a number of enterprises. The overall economic impact of introducing developments under this comprehensive program has been 26.5 million rubles.

The problem of using heat- and mass-exchange in technological processes is one of 10 comprehensive problems being solved through the joint efforts of three

fraternal republics -- the Ukraine, Moldavia and Belorussia. Among the others are the study and effective use of natural resources in the Poles'ye [forest belt] and the Dnepr', Pripyat' and Dnestr basins, the development of breeder reactors with dissociation heat transfer agents, the development of new methods of improving agricultural production efficiency on a basis of achievements in the fields of genetics and breeding.

The BSSR Academy of Sciences has broadened its scientific contacts with academy of sciences institutions of Central Asia. Joint research is being done on developing software for a unified series of computers, on low-temperature plasma physics and engineering, of the physics of crystals, on planning automation and other problems.

Cooperation between scientists at higher academic institutions of Belorussia and other republics is being intensively developed. VUZ's are working on upwards of 300 topics just under coordination plans of the USSR and union republic academies of sciences. They are based on scientific-technical cooperation agreements of a mutually-enriching nature. The experience of the Belorussian and Ukrainian SSR's confirms this. When scientists of the Arc Welding Institute imeni Ye. O. Paton were faced with the problem of improving the reliability and productivity of monitoring important items and checking the quality of welded multilayer pipe, specialists at the Belorussian Polytechnical Institute came to their assistance and proposed a fundamentally new way of resolving the task.

The May (1982) CPSU Central Committee Plenum defined implementation of the USSR Food Program for the period up to 1990 as a most important component of the economic strategy of the Communist Party of the Soviet Union. The purpose of the steps planned, the CPSU Central Committee Plenum emphasized, is to ensure a reliable food supply to the populace as quickly as possible. This is not only a top-priority economic task, but also a pressing sociopolitical one. The laborers of Soviet Belorussia and Belorussian science, together with all the Soviet people, will doubtless make a worthy contribution to carrying it out.

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ESTONIAN CONTRIBUTIONS TO SOVIET SCIENTIFIC POTENTIAL DISCUSSED

Tallinn KOMMUNIST ESTONII in Russian No 2, Dec 82 pp 53-57

[Article by A. Keyerna, Vice President, ESSR Academy of Sciences, and G. Varlamova, Deputy Chief Scientific Secretary, ESSR Academy of Sciences: "A Component Part of the Unionwide Scientific Potential"]

[Text] In the socialist society, science serves as a powerful motivating force for social progress. The Report of the CPSU Central Committee to the 26th CPSU Congress states, "The party of Communists proceeds from the fact that the construction of the new society without science is simply inconceivable." At the given stage of communist construction, under conditions of the changeover of the economy to its intensive development, the role of science is increasing immeasurably. The tasks that are being moved into the foreground are the tasks of the more intensive and more effective use of the scientific potential, the closer integration of science and practice, and the improvement of their interrelationships.

At the present time our country possesses a tremendous scientific potential. In science itself and the areas that service it, there are more than 4.3 million persons working, including more than 1.3 scientific associates. Many results of Soviet researchers are fundamental ones in world science.

The control of scientific activities under the conditions of intensive development has its specifics: substantial importance is attached to the coordination and interrelationship of the administration of regional science with the overall principles of the administration of science. The scientific organizations in our republic constitute part of the single unionwide scientific potential, and implement a single scientific-technical policy. At the same time they resolve numerous tasks of regional socioeconomic development, and the development and placement of the productive forces.

The academies of sciences of the unionrepublics represent leading scientific centers that have been called upon to guarantee both the further development of fundamental research projects and the resolution of the applied tasks that are typical of the particular region. From these positions it is not without interest to analyze the scientific potential of the academies of sciences of the union republics, which, as is well known, is made up of the cadres, finance, material-technical base, etc. that science has at its disposal.

As of 1 January 1982 the number of persons working in institutions of the USSR Academy of Sciences system was 392,328, of whom 196,109, or approximately half, were working in the academies of sciences of the union republic. The largest among the academies of sciences of the union republics is the UkSSR Academy of Sciences (42.6 percent of the persons working in republic academies). The ESSR Academy of Sciences is one of the smallest -- only 2.2 percent of the total number of associates employed in the academies of sciences of the union republics. The share of the scientific associates in the overall number of persons working in academies varies substantially: from 50 (GSSR Academy of Sciences) to 18 percent (UkSSR Academy of Sciences), with the average figure being 33 percent. At the ESSR Academy of Sciences this indicator is 26.5 percent. Something else that is extremely uneven is the distribution of the share of the scientific associates with a degree in the overall number of scientific associates: from 65 in LaSSR Academy of Sciences to 34 percent in BSSR, with the average figure 49 percent. At ESSR Academy of Sciences, the figure is 57 percent. It should be noted that the academies of sciences of the union republics possess a considerable cadre potential both quantitatively and qualitatively. At the present time, during the period of the intensive development of science, problems that are especially vital ones are those involving the most effective use of the existing cadre potential, and the achievement in academy institutes of an efficient correlation between associates with a learned degree and those without it, and the auxiliary personnel.

As for the current expenditures for scientific purposes, ESSR Academy of Sciences yields only to the academies of sciences of the Ukraine, Belorussia, and Latvia.

Recently in the financing of academy institutions one has observed a tendency toward an increase in the share of projects carried out on the basis of economic contracts. Whereas at the beginning of the 1970's the norm was considered to be 20 percent of economic-contract projects in the overall sum of financing, at the present time that indicator has increased substantially and at BSSR and UkSSR Academies of Sciences it has reached 50 percent, with an average value for the academies of sciences of the union republics of 37 percent (ESSR Academy of Sciences, 30 percent).

When considering the material-technical aspect of the scientific potential of the academies of the union republics, one should note the different level in the extent to which they have been provided with fixed assets. With regard its level of provision with assets, ESSR Academy of Sciences yields only to LaSSR Academy of Sciences. The carrying out of scientific research on a world level requires a modern, developed material-technical base, and therefore the establishment here of any limit or criterion is impossible. A factor of great importance is the nature of the problems to be resolved in a particular republic. For example, physical or astronomic research requires, as a rule, more expensive apparatus than biological or zoological research.

During the period of the intensive development of science, the administrators of the scientific organizations face the tasks of the buildup and the more effective use of the scientific potential under conditions of a limitation of the personnel and financial resources. Its successful resolution is possible

only with the correct planning of scientific research, the efficient use of the cadres, and skillful administration.

The conditions that have been mentioned also presuppose the accelerated development of research in the field of science studies and science measurement, as a result of which one can and must obtain concrete recommendations and criteria for assessing the activities of the scientific associates, collectives of scientists, etc.

Although ESSR Academy of Sciences is extremely small in number of personnel, the workers in its institutes and special design bureaus have made a noticeable contribution to the development of Soviet science. For example, scientists at the institutes of the Department of Physical-Mathematical and Technical Sciences achieved considerable results in the area of structural research. A central place is occupied by solid-body physics, primarily research on molecular crystals by optical methods. In recognition of projects in the study of the optical and spectral properties of condensed phases, the president of ESSR Academy of Sciences, Corresponding Member of USSR Academy of Sciences, K. K. Rebane was awarded the Gold Medal imeni A. N. Lebedev. A detailed research study on low-temperature vibron spectra of crystals led to the discovery of a new phenomenon -- hot photoluminescence of crystals (discovery No. 243; originators K. K. Rebane, P. M. Saari, V. V. Khizhnyakov).

The Institute of Physics and the SKB [Special Design Bureau] have developed and are producing excimer and nitrogen pulse lasers and reorganizable lasers based on dyes, instead of those with control and measurement systems. Polycrystal transparent zeolites have been obtained -- halogen-sodalites that are suitable for recording information by an electronic beam or by radiation. The Institute of Chemical and Biological Physics has created methods and apparatus for the recording of and research on the spectra of the nuclear magnetic resonance of the high resolution of solid bodies; this has made it possible to establish the detailed structure of the zeolites and other alumosilicates. The theory of nuclear magnetic resonance of quadrupole nuclei was developed and the Soviet Union's first spectrometer for ion-cyclotron resonance has been created: it is a mass-spectrometer with unusually high resolution and sensitivity.

The successful application of the latest methods during the study of weak galaxies enabled the Institute of Astrophysics and Physics of the Atmosphere, ESSR Academy of Sciences, to establish and refine the cellular structure of the Universe. The study of the optical properties and radiation regime of the earth's atmosphere and underlying locality made it possible to develop effective methods for assessing the condition of agricultural crops. The projects that were mentioned are closely linked with projects at the Institute of thermophysics and Electrophysics that involve the study of the pollution of the Baltic Sea, including those carried out by the collective of the Ayu-Dag scientific-research expeditionary ship. This institute has also carried out systematic study on optimizing the fuel and energy balance sheets of the economic regions and has obtained preliminary results during the combustion of *kukersit* [bituminous shale] in a boiling stratum. A good example of the application of large-capacity electronics is the development of

sources for the feeding of powerful electromagnets with a capacity of up to 20 megawatts.

Most of the projects being carried out have been included in target scientific-technical programs of the USSR State Committee for Science and Technology and USSR Academy of Sciences. It is especially necessary to mention the projects on physico-chemical biology and biotechnology. Methods of gene engineering, preparative micribiological synthesis, and the isolation of especially pure biopreparations have been assimilated. Many biopreparations that are being manufactured are used in other USSR laboratories, and are exported to the United States and West Germany.

Research projects that are of great importance are the ones that were begun in 1976 by the Institute of Chemistry, ESSR Academy of Sciences, with the purpose of developing the scientific principles of synthesizing important bioregulators of mammals -- prostaglandines. The preparation *prostenon*, which is used to stimulate birth, has been manufactured. The regulation of the sexual cycle of cows is promoted by the preparation *tsiklosin*. Methods have been developed to obtain a number of important metabolites of arachidonic acid. Within the confines of the research trend "fine organic synthesis," new means of combatting harmful insects -- *yuvenoids* and *feromons* -- have been synthesized.

The Institute of Geology has developed and introduced into the practice of geological cartography and the search for minerals stratigraphic schemes for all the geological subdivisions encountered in the region, which schemes are drawn up on the basis of the generalization of many years of comprehensive subject-matter research projects. A factor of great importance for the development of the agriculture of the Baltic republics and the neighboring territories is the methodology that has been developed by geologists for assessing the admissible technology loads to be placed on the underground water in agricultural landscapes.

The Institute of Experimental Biology, ESSR Academy of Sciences, has been studying the genetic principles of selection of agricultural plants. The genetic nature of resistance to brown rust has been ascertained for more than 150 varieties, mutants, and hybrids of soft wheat and it has been proved that resistance for most of the genotypes is controlled by a single gene. Projects involving chemical and radiation mutagenesis are being carried out.

The genetic principles of selection of agricultural animals are being used to study the possibilities of employing methods of population genetics with the purpose of increasing the effectiveness of selection of cattle. ESSR Ministry of Agriculture has had transferred to it, for the purpose of introduction, the method of selection indexes, which makes it possible to increase the effectiveness of selection by approximately 1.5 times.

The Institute of Zoology and Botany has completed the preparation of the 11-volume "Flora Estonskaya SSR" [Flora of Estonian SSR], which contains a detailed description and analysis of the significance to the national economy of approximately 3000 species of plants.

As a result of comprehensive hydrobiological research projects, a determination has been made of the trophic state of various types of lakes in Estonia (including the major lakes -- Pskovsko-Chudskoye and Vyrts"yarv) according to their basic bioindicators. A comprehensive limnological classification of the lakes of Estonia has been developed. By means of an analysis of the hydrochemical regime of the lakes, changes have been ascertained in the hydrochemical indicators of the basic types of lakes during recent years and the background of the content of organic matter and macroelements in the pelagene by types of lakes.

The Tallinn Botanical Garden, by means of the quantitative evaluation of the key indicators of the ecosystems under various anthropogenic influences, has developed the concept of the anthropotolerancy of ecosystems and has developed practical methods for protecting the environment of agricultural landscapes with a consideration of industrial mining production.

The Institute of Economics, ESSR Academy of Sciences, jointly with the construction-design institutes, has developed and introduced "Instruction Manual for the Carrying Out of Economical-Mathematical Computations of Electronic Computers During the Designing of Regional Gas-Supply Systems," with an annual economic benefit of 956,000 rubles.

Jointly with the Institute of Marxism-Leninism, under the CPSU Central Committee; the institutes of party history, under the Central Committees of the Communist Parties of Latvia, Lithuania, and Estonia; and the institutes of history of the Academies of Sciences of Latvian and Lithuanian SSR, the Institute of History, ESSR Academy of Sciences, has participated in the preparation of the collective monograph "Sotsialisticheskaya revolyutsiya 1940 g. v Litve, Latvii i Estoniii. Vosstanovleniye Sovetskoy vlasti" [The 1940 Socialist Revolution in Lithuania, Latvia, and Estonia: The Restoration of the Soviet Authority]. The publication of the 3-volume "Istoriya Estonskoy SSR" [History of Estonian SSR]" has been completed.

The Institute of Language and Literature, ESSR Academy of Sciences, is conducting a project for the processing, unification, and introduction into practice of Russian-Estonian terminology and terminological standards for various branches of the national economy ("Russko-estonskiy slovar' naimenovaniy professiy rabochikh i dolzhnostey sluzhashchikh" [Russian-Estonian Dictionary of Names of Occupations of Workers and Employees], "Russko-estonskiy khimicheskiy slovar'" [Russian-Estonian Chemical Dictionary], and approximately 30 terminological standards). The institute's Computer Linguistics Sector has implemented a system for automating psychoacoustic experiments, which makes it possible to obtain feedback with six parameters.

As can be seen from what has been stated, the scientific research being carried out in the republic is an organic part of the series of problems being developed by Soviet science. Therefore the activities of the scientific institutions and institutions of higher learning in the republic are closely linked with the work of other scientific centers in our country.

The scientific cooperation is carried out in many forms, particularly such forms as joint research projects and the joint publication of the results in

the form of collective monographs, collections of scientific works, etc.; long-term temporary-duty assignments (probationary periods) for scientific associates to work in large-scale laboratories that are equipped with the latest equipment; participation in scientific conferences; joint work and the coordination of activities in unionwide scientific councils; reciprocal supplying of one-of-a-kind equipment.

Our republic's central scientific organization is ESSR Academy of Sciences. Its ties can serve as a graphic example of the scientific cooperation among the scientists in the fraternal republics. The geography of the cooperation is extensive and encompasses practically all the union republics and the major scientific centers.

The Institute of Astrophysics and the Physics of the Atmosphere cooperates actively with the Byurakan Astrophysical Observatory, ArSSR Academy of Sciences; the Abastumani Astrophysical Observatory, GSSR Academy of Sciences; and the Moletay Astrophysical Observatory, LiSSR Academy of Sciences, in the conducting of visual astrophysical observations. The institute also has extensive ties in the development and testing of scientific apparatus for observations of the earth's surface from satellites and aircraft -- ties with the State Optics Institute imeni S. I. Vavilov (Leningrad), TsNII [Central Scientific-Research Institute] "Kometa" (Moscow); the Institute of Space Research, USSR Academy of Sciences (Moscow).

The Laser Technology Group, ESSR Academy of Sciences, carries out scientific-technical cooperation and the exchange of experience with the State Institute of Applied Chemistry in research on and development of active media for excimer lasers; with Leningrad Polythechnical Institute, in research on the possibilities of creating excimer lasers with pumping by a special electron beam; with the Tomsk Physico-Tehnical Institute, under Tomsk State University, in research on and the creation of working media for lasers based on dyes. The Semiconductor Physics Sector, jointly with the State Institute of Rare Metals (Moscow), has introduced at enterprises of USSR Ministry of the Electronic Industry, a technological scheme for the manufacture of epitaxial heterostructure Al-Ga-As-Sb. Associates at the Instrument-Building Sector, jointly with the Experimental Design Base under the Moscow Electrovacuum Instruments Plant, carried out experiments involving the creation of solar-blind photoelements for the VUF-area of the spectrum, and have studied the spectral characteristics of experimental photoelements.

In the field of the application of methods of nuclear magnetic resonance, close collaboration is continuing between the Institute of Chemical and Biological Physics, ESSR Academy of Sciences, and the Institute of Organic Chemistry, Siberian Branch of the USSR Academy of Sciences (Irkutsk); Moscow State University; Institute of Physics, LaSSR Academy of Sciences; Institute of Geology and Geochemistry of Fuel Shales, UkSSR Academy of Sciences (Kiev); and other institutions.

The Institute of Cybernetics, ESSR Academy of Sciences, is carrying out a constant exchange of experience with the computer center of the Siberian Branch of USSR Academy of Sciences in the operation of systems and applied mathematical support for the YeS EBM [Unified System of Electronic Computers] and

the introduction of the PRIZ programming system. Together with the Institute of Problems of Mechanics, USSR Academy of Sciences; the Leningrad Polytechnical Institute imeni M. I. Kalinin; and the NII [Scientific-Research Institute] of Mechanics and Applied Mathematics, of the North Caucasus Scientific Center, the Mechanics Sector of the Institute of Cybernetics, ESSR Academy of Sciences, is a co-organizer of the permanent unionwide seminar on general problems of the nonlinear mechanics of the continuous medium.

The Institute of Thermophysics and Electrophysics, ESSR, has carried out joint research to optimize fuel and energy balance sheets -- with the Siberian Energy Institute of the Siberian Branch of the USSR Academy of Sciences (Irkutsk); to study the Baltic Sea -- with the State Oceanographic Institute for the Control of the Environment; the Institute of Biology, LaSSR Academy of Sciences; the Institute of Zoology and Parasitology, LiSSR Academy of Sciences; the Naval Hydrophysics Institute, UkSSR Academy of Sciences; and the Institute of Oceanology, USSR Academy of Sciences; to study the aerodynamics of fine-dispersion currents -- with the NII of Thermal Processes (Moscow); etc.

The Institute of Chemistry, ESSR Academy of Sciences, has concluded numerous contracts with various ministries (Moscow, ArSSR, LaSSR, etc.) concerning the conducting of tests of the *feromons* and *yuvenoids* that were developed and synthesized in our institute. In the area of the synthesis of new surface-active substances for the motion-picture and photography industry, household chemistry, and also the use for those purposes of waste products from the canned-fish industry, the institute maintains close creative and contract ties with the Institute of Physical Chemistry, USSR Academy of Sciences; Moscow State University; and Leningrad Technological Institute imeni Lensovet.

The Institute of Geology, ESSR Academy of Sciences, has concluded new long-term contracts with the Arctic and Antarctic NII; the Institute of Geography, USSR Academy of Sciences; Leningrad Mining Institute; and Moscow State University on the comprehensive research of the glacial covers and glaciers of Antarctica and the Arctic. On the basis of a contract with the Aeromethods Laboratory of the Aerogeologiya Association, USSR Ministry of Geology, the methodology is being improved for the application of the materials of aerial photographic surveying during geological-geomorphological research in the Northwest of the USSR. Together with specialists from the construction-planning institutes and the Institute of Geology and Geophysics, of the Siberian Branch, USSR Academy of Sciences, a preliminary plan has been developed for preparing a series of paleogeographical maps of various regions of the Silurian in the USSR. The maps being prepared are analogous to the maps of the Scandinavian-Baltic region and reflect short segments in the development of the drainage areas. Business contacts have been arranged with specialists of the Urals Geo-Administration and the Institute of Geology and Geochemistry, of the Urals Scientific Center, USSR Academy of Sciences, with the purpose of organizing the collective study of the territorial drainage areas of the East European platform during the Silurian period.

Associates of the Institute of Experimental Biology, ESSR Academy of Sciences, carried out the following joint projects: with the Institute of Molecular Biology, USSR Academy of Sciences -- to study the fine structure of chromosomes;

with Leningrad State University -- to study the genetic properties of remote wheat-rust hybrids; with the All-Union NII of Vegetable Husbandry imeni M. I. Vavilov -- to obtain remote hybrids of wheat that are resistant to a series of hydrid diseases; with the Institute of Chemical Physics, USSR Academy of Sciences -- to study the recombinatorial capability of mutations in phage T4; etc.

The Institute of Zoology and Botany, ESSR Academy of Sciences, in accordance with a contract for cooperation with the Azerbaijan NII for the Protection of Plants, carried out joint research for purposes of developing methods of employing *yuvenoids* in the fight against harmful insects. Joint research has also been carried out with the Zoological Institute, USSR Academy of Sciences, for the establishment of the productivity and species composition of Rotifera in biocenoses of internal bodies of water; with the Botanical Institute, USSR Academy of Sciences, and the Institute of Botany, TaSSR Academy of Sciences -- on the systematics of Discomycetes; with the Institute of Microbiology, UzSSR Academy of Sciences and the Institute of Botany, TaSSR Academy of Sciences -- to study the flora of agaric fungi; with the Institute of the Physiology and Experimental Pathology of High-Altitude Areas, KiSSR Academy of Sciences -- on the telemetric study of agricultural animals; and with the Institute of Biology, Karelian Branch of the USSR Academy of Sciences -- on radio-carbon dating of biological, geological, and archeological items.

The associates of the Tallinn Botanical Garden maintain close ties with the scientific institutions of other republics. Together with workers of the Botanical Institute imeni Komarov, USSR Academy of Sciences, they studied the zonality of biological phenomena in the Taymyr; and with workers of Moscow State University -- the ecology and development of swamp ecosystems in Western Siberia. Joinly with the Institute of Agrochemistry and Soil Science, USSR Academy of Sciences, projects have been conducted to ascertain the change in the underlying natural laws governing the chemical composition of lichens and mosses under extremely varying conditions of the environment.

The Institute of Economics, ESSR Academy of Sciences, has established fruitful contacts with the Council for the Study of Productive Forces, attached to USSR Gosplan;with the Institutes of Economics of LiSSR and LaSSR Academies of Sciences--- on questions of forecasting and planning the development and placement of the productive forces; with the Institute of State and Law, USSR Academy of Sciences -- on questions of studying legal problems in the protection of the environment; with VNIIEgazprom (Moscow) and Planning Institute (Leningrad) -- on the conducting of economic-mathematical computations during the planning of regional gas-supply systems; etc.

The Sector of the History of Culture and Ethnography, of the Institute of History, ESSR Academy of Sciences, cooperates with the Institute of Ethnography imeni M. I. Miklukho-Maklay, USSR Academy of Sciences. An ethnographic atlas of the Baltic nations is being prepared for the press.

The Computer Linguistics Sector of the Institute of Language and Literature, ESSR Academy of Sciences, jointly with the Institute of Administrative Problems, USSR Minpribor, and with the Central Economic-Mathematical Institute, USSR Academy of Sciences, are developing the problem "Data Banks and

Information-Search Systems." Associates of the Sector of the History of Literature at our institute have taken active part in the preparation of the collective work of the Institute of World Literature imeni A. M. Gor'kiy, USSR Academy of Sciences, "Istoriya literatur narodov SSSR dooktyabr'skogo perioda" [History of the Literatures of the Peoples of the USSR in the Pre-October Period] and are continuing the work on the sections of "Istoriya vsemirnoy literatury" [History of World Literature].

The close collaboration among the scientists of the fraternal republics serves to increase the effectiveness of scientific work, helps to avoid parallelism and duplication, and contributes to the most rapid implementation of the results of research in the practical situation.

Marking the 60th anniversary of the formation of the USSR, the Academy of Sciences of ESSR is continuing to develop the cooperation with the scientific organizations of the other union republics.

5075
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PATON ON THE EFFECTIVENESS OF SCIENCE IN THE UKRAINE

Kiev RADYANS'KA UKRAYINA in Ukrainian 2 Apr 83 p 2

[Article by B. Paton, President, UkrSSR Academy of Sciences, twice Hero of Socialist Labor]

[Text] As is well-known, basic research is the scientific lever of social production. It is precisely it which designates in fact revolutionary change in technique, technology and the economy. Scientists of the republic give constant attention to it.

Guided by decisions of the 26th CPSU Congress and the 26th CPUkr Congress and the May and November 1982 Plenums of the CPSU Central Committee, scientists of the UkrSSR Academy of Sciences are directing their efforts toward intensification of their investigations, increasing the contributions of science to the resolution of problems in the intensive development of the national economy and the realization of the Provisions Program. The gains are significant in literally each branch of science.

Mathematicians, for example, have developed a theory of multifrequency oscillations which makes it possible to study models of complex phenomena in nonlinear mechanics, nuclear physics, electronics, radio and electricsl engineering. A large contribution also has been made to the development of functional analysis, a number of important questions of the theory of reliability of complex systems have been solved. However, expansion of the scales of use of mathematical methods in contemporary natural science, technology and production requires further intensification of research in the most important directions of mathematics and the creation of effective methods of solving practical problems.

Cybernetics has obtained fundamental results in the general theory of controls, paperless information and system optimization. Great possibilities are opened up for the progress of the branch by the theory of construction of multiprocessor highly productive electronic calculating machines developed by the scientists.

In this branch an important problem is the further development of theoretical and technical problems in the creation of new generations of very high speed coputers. Great scientific-technical and social importance is being acquired by the creation on the basis of bionic investigations of robots and manipulators, and in the long term also of complex autonomous robots endowed with "artificial intelligence."

An important achievementof mechanics in recent time is the designation of clear criteria for evaluating the crack resistance of materials of large structures of atomic reactor construction. They have developed some theoretical points which are of great importance for the construction of new technology, increasing the quality of construction of machines for various purposes.

Physicists have conducted unique experiments which have practical value for the development of new approaches in nuclear physics and solid state physics. Taking into account the importance of nuclear physics for the further development of power eningeering, investigations are being intensified in the physics of the atomic nucleus and nuclear reactions and research is being conducted for ways to recreate nuclear fuel.

Real results have also be obtained by the work of our material specialists. They have developed the physical and technical principles for obtaining new multilayer fire-resistant materials, the prototype of a new foundry aggregate for the formation of ingots by lots has been created and successfully tested, and a number of other interesting developments have been made.

In solving tasks of the intensive development of the country's economy, a large role belongs to ferrous metallurgy as the leading branch of an important industry. This requires of scientists further efforts to perfect methods of obtaining and rationally expending metallic materials, reducing the metal content of structures and machines, expanding the assortment and improving the quality of metals and alloys and creating progressive methods of powder metallurgy.

The developments of scientists of the UkrSSR Academy of Sciences have great importance for the performance of tasks set in the Foodstuffs Program of the region. Today in the branch of biological sciences new data have been obtained on growth of the processes of plants on the cellular and subcellular levels. New high-yield varieties of fodder and food crops have been introduced, besides highly productive varieties of sugar beets "Industrial'nyy."

Special urgency is acquired by investigations directed toward further study of complex reactions which take place in the living organism, caused by mechanisms of neural and hormonal regulation of the exchange of substances in the norm and in pathology, which is of special importance for the prevention and cure of various diseases.

Remaining at the center of attention of researchers are such large problems as the obtaining of proteins and bonded nitrogen, the development of biochemical principles of increasing the productivity of agricultural animals.

The past year became an important stage in the implementation of contracts between our academy and enterprises of oblasts of the republic. Of 1200 problems of joint works planned for the current Five-Year Plan, more than a fourth have been completed already. And the successes of the scientific centers have been stipulated to a great extent by the assistance given to them by oblast committees of the Communist Party of the Ukraine.

An important feature of contemporary science is the interpenetration and growing together of basic and applied research. This objectively leads to the energence of research of a class new in principle--"purposeful basic." Basic in its character, it is directed toward solving specific problems of great national economic importance. Such investigations should first be included in our plans, and the latest achievements must be taken into account both in our own country and abroad. These help to concentrate efforts on the most pressing directions of scienfic and technological progress.

An important scientific task, besides, is the creation of electronic computer technology new in principle--optical computers with direct data input over the video channel and superpowerful computers with an operating speed 100 times greater than the latest models. In the long term a paramount value is acquired by transition in computer technology to biological crystals, the creation of "artificial intellects." In connection with that there has to be expansion of purposeful basic research on the creation of systems of fiber optics, hybrid electron-optical integrated circuits and developments of photon optics.

In the thinking of specialists, the 1980's will be a period of further revolution in materials technology. Great changes will be accomplished both in the processes of production of new materials and in their use. This will require from scientists intensification of research on the creation of new ceramic materials, especially those malleable as metal, and new methods of their combination and processing.

Unusually promising are investigations of the physics of surfaces, which make it possible not only to sharply increase the corrosion and abrasive resistance of parts and achieve accelerated catalytic reactions by hundreds and thousands of times. A possible result of this can be the formation of fuels by direct combination of water and carbon monoxide in the presence of catalyst.

Purposeful research is of very great importance for the development of such a new branch as biotechnology. Methods of biotechnology make it possible to create new types of high-yield agricultural plants resistant to unfavorable climate and even capable of protecting their good qualities.

The role of biotechnology also is large in the creation of biological crystals, the transformation of achieved biomass into cheap fuel, and also obtaining it by decomposing water into hydrogen and oxygen.

Corresponding to the tasks of scientists are increases of the contribution to the acceleration of scientific, technological and social progress, further changes of the connections of science and production, intensification of social production, improvement of the disposition of productive forces and the solution of ecological problems. Such forms of connection of science and practice as joint work with ministries with complex plans of scientific research have well recommended themselves, as well as the introduction of developments with complex scientific and technical programs with branch scientific research institutes and production collectives. Today the Academy is fruitfully collaborating with more than 20 ministries and departments of union, union republic and republic subordination.

Here is an example of such collaboration. At the Kiev Production Combine imeni B. P. Korol'ov a joint sesseion of the Presidium of the Academy of Sciences and the Board of the Branch Ministry was held. At it was enacted a program of work in basic research, the creation and use of microprocessor technology, methods of automating planning, new technologies and elementary bsess for information collection, processing and transmission systems.

Expansion of collaboration with the branch ministries is one of the most effective forms of influence of science on production. This line will also be carried out in the future. Scientists wish the joint solutions of problems not to have a

random character, but create the necessary preconditions for fundamental disturbances in the paths of branches of production.

A problem of paramount importance, as earlier, is the creation of a highly effective technology on the basis of the results of investigations. Life has convinvincingly confirmed that they proceeded to test the method of increasing the level of production, an effective factor of its intensification. The introduction of such technologies, first of all, involves the interests of the basic branches of the national economy--metallurgy, mchine-building, fuel and energy complexes, chemistry, etc.

Exceptionally large is the role of technology also in the development of an agro-industrial complex, in the realization of tasks of the Foodstuffs Program. Scientists of the Academy of Sciences are actively included in this work, regard it as their high civic and patriotic duty. Today 65 adademic institutes are participating in working out tasks of the Foodstuffs Program, among wihch is the creation of high-yielding agricultural crops, the creation of means of their protection against disease and injuries, the obtaining of new fodders for animal husbandry, the reduction of expenditures in the collection and processing of grains, vegetables and fruits, and the perfection of technology.

The scientific collectives of the UkrSSR Academy of Sciences are participating in the implementation of 160 union complex scientific-technological programs, on 17 of which our Academy of Science is the responsible executor. Important work is also being done on republic programs. For example, within the framework of the "Energokompleks" program there has been a substantial increase in the volume of research which envisages finding new energy resources, increase of the exploration of stocks of oil and gas and perfection of methods of geological surveying.

During the program "Material Content" at four plants of the republic the production of differentiated rolled iron has been mastered. On the basis of new micropowder synthetic diamonds pastes and suspensions have been developed and produced for the finishing of the surfaces of manufactured products. The participation of our academy in the execution of the republican planned program "Metal" has been expanded.

The contribution of our scientists to the implementation of other complex programs also is considerable. Therefore it should be pointed out that the possibilities of the scientific potentia of the republic in this matter are still not being completely utilized. It is necessary for us to more clearly designate our role in the implementation of all six republican scientific-technical programs and jointly with the appropriate ministries and departments actively obtain their realization.

2174
CSO; 1811/37

TAJIK ACADEMY OF SCIENCES PRESIDENT ON PROGRESS, PROSPECTS

Alma-Ata AKADEMII NAUK KAZAKHSKOY SSR in Russian No 10, Oct 82 pp 3-12

[Third in a series of articles by presidents of union republic academies of sciences: M. S. Asimov, President of the Tajik SSR Academy of Sciences and Corresponding Member of the USSR Academy of Sciences, under the heading "Union Republic Academy of Sciences Presidents Respond to VESTNIK AN KAZSSR Questions"]

[Text] On the threshold of the 60th anniversary of the formation of the Union of Soviet Socialist Republics, the editorial staff of VESTNIK AN KAZSSR requested the presidents of the union republic academies of sciences with which the Academy of Sciences has creative scientific ties to respond to the following questions: 1) What are the basic achievements of your Academy of Sciences during the years of Soviet power, especially this past decade? 2) What are the most unique scientific developments of your academy? 3) What are the creative ties, the joint developments, of your Academy of Sciences and the Kazakh SSR Academy of Sciences and the prospects for their development? This issue, we are publishing the responses of USSR Academy of Sciences corresponding member M. S. Asimov, President of the Tajik SSR Academy of Sciences. Publication of the responses began in Nos 8 and 9 and will continue in subsequent issues of the journal.

1-2. During the years of Soviet power, science in Tajikistan has been significantly developed.

At present, the republic Academy of Sciences has been transformed into one of the largest comprehensive centers of major Soviet science. It includes 20 scientific research institutions in which about 4,000 people work, including more than 600 doctors and candidates of sciences, 20 academicians and 29 corresponding members of the Tajik SSR Academy of Sciences. Many of the most important branches of Soviet sciences, physicomathematics, chemistry, biology, earth science, medicine and social science, are represented in the Academy.

In the anniversary year of the formation of the USSR, speaking about the major achievements of scientists of our Academy, we recall with gratitude the emissaries of the great Russian people -- researchers and travelers A. P. Fedchenko,

V. F. Oshanin, N. A. Severtsev, V. L. Komarov, I. V. Mushketov, D. V. Nalivkin, D. L. Ivanov, M. S. Andreyev and many others. Under the very difficult conditions of prerevolutionary Tajikistan, they laid the foundation for studying the flora and fauna, geology and geography of our region and informed the whole world about the history of the peoples of Central Asia, about their rich and ancient culture. Their names entered the annals of the friendship between the Tajik and other peoples of Central Asia and the Great Russian people. And if the research by Russian scientists in prerevolutionary Tajikistan was unable to exert a substantial influence on development of the region's economy and culture, it was the fault of the social conditions existing at that time.

Soviet power has fundamentally altered the attitude towards science in general, including in national regions of the country. Science has been transformed into a matter of state importance and has become a subject of special concern for the party and the people.

Briefly about the main eras of scientific development in the country. A number of scientific expeditions have been organized to study productive forces and determine the nature and extent of raw material resources in Tajikistan and prospects for its industrial and agricultural utilization. Most important among them are the 1928 Pamir Expedition and the multipurpose 1932 Tajik-Pamir Expedition, whose 50th anniversary we recently celebrated. These expeditions were led by D. I. Shcherbakov and N. P. Gorbunov. Participating in the work of the expeditions were some outstanding Russian scientists: D. V. Nalivkin, Ye. N. Pavlovskiy, A. Ye. Fersman, V. L. Komarov, N. I. Vavilov and others. It would be difficult to overestimate the contribution of these scientists to the extensive scientific research done in Tajikistan. They actually became trail-blazers of science in the republic, discoverers of the natural riches of our region; they determined its economic development potential and outlined a concrete scientific plan for developing republic productive forces. With the assistance of the expeditions, the first scientific institutions specialized for agriculture and medicine were organized in the republic.

A number of scientific institutions and societies which played a significant role in the establishment of science in Tajikistan were created in the 1920's and early 1930's. A scientific committee was created under the Tajik SSR Central Executive Committee in early 1930 to head up the planning of all scientific work in the republic, and in August 1930 the USSR Academy of Sciences decided to create a commission for a scientific survey of the Tajik SSR. The commission included prominent scientists in the country. This commission did a great deal of work on determining the prospects for and basic directions of scientific research in our republic. With the direct assistance of the USSR Academy of Sciences and other central scientific institutions, by late 1932 there were already 13 scientific institutions in Tajikistan, including tropics and sanitation-bacteriology institutes, the Cotton Scientific Research Institute and the Astronomy Observatory.

This permitted the creation of a unified science center in the republic in 1933 -- the Tajik Center of the USSR Academy of Sciences, headed by a prominent specialist on Eastern affairs, Academician S. F. Ol'denburg. Sectors for geology, botany, zoology, parasitology, soil science and the humanities were organized as

part of it. This base provided a powerful new impetus to the development of science in the republic, facilitated the development of research connected with resolving the top-priority economic and cultural tasks of the new republic. Much was done on problems of utilizing new land, developing agricultural production and providing industry with a raw material base. The research took on a comprehensive character.

In early 1941, the center was converted into the Tajik Branch of the USSR Academy of Sciences, with scientific research institutes for geology, botany, zoology and parasitology, history, language and literature. Ye. N. Pavlovskiy became chairman of the presidium of the Tajik Branch of the USSR Academy of Sciences. We remember with great respect the name of this outstanding scientist, who long associated his scientific activity with Tajikistan, contributing much effort and energy to organizing and developing public health and science in the republic. His name is borne by one of the oldest scientific research institutes of our academy.

During the terrible years of World War II and the post-war period, institutes of stockraising and chemistry, a geophysics sector with three seismology stations and a dictionaries sector attached to the Institute of History, Language and Literature were created within the branch. The branch played a significant role in training a large detachment of scientists.

Scientists at the Tajik Branch of the USSR Academy of Sciences did very important research in the fields of geology, botany, parasitology, agriculture, medicine, and the Tajik language, literature and history. During the years of Soviet power and building socialism in Tajikistan, Academician Ye. N. Pavlovskiy has noted, scientific research institutions of the Tajik Branch of the USSR Academy of Sciences have grown into large institutes capable of posing and solving independent scientific problems connected with the requirements of the national economy and the country's culture.

All this permitted establishment of the Tajik SSR Academy of Sciences based on the USSR Academy of Sciences branch. The first session of the republic academy of sciences was festively opened on 14 April 1951, laying the foundation for its activity. The founder of Tajik Soviet literature and a famous scientist specializing in Eastern affairs, Sadriddin Saidmuradovich Ayni, was elected its first president at the General Meeting of the Tajik SSR Academy of Sciences. The academy included important scientists and cultural activists of the republic.

The establishment of the Tajik SSR Academy of Sciences was a result of the party's wise Leninist national policy, aimed at eliminating the actual inequality of the peoples of our country, at creating every condition [necessary] for the economic and cultural progress of previously backward peoples and drawing them into active creative activity. It was made possible by the mighty creative force of the friendship and mutual assistance of the socialist nations, and foremost the diverse assistance rendered Tajikistan by the Russian people. The assistance of Russian scientists and other peoples of the country, the attention and support of the USSR Academy of Sciences, played a decisive role in developing science in our republic, in creating the Tajik SSR Academy of Sciences, in all its subsequent activity.

Since that time, there has been an intensive accumulation of scientific potential: the material-technical base of science has been created, scientific personnel have been trained, research has been developed along the modern lines of science, work has been done to set up new scientific research institutions. Much important research has been completed in mathematics, physics, astrophysice, seismology, chemistry, biology, medicine and geology, research which has made an important contribution in a number of fields of science and practice. Much work has been done on studying the natural resources of Tajikistan and the productiveness of agricultural production has been increased. Numerous works have been prepared and published on history, philosophy, economics, philology, art criticism and ethnography.

In the field of mathematics, we could cite as fundamental achievements the results of research on equation systems of the compound type and elliptical equations with singular coefficients. Our mathematicians were the first to develop the theory of boundary value problems for equation systems with compound-type partial products having two or many independent variables. An analytical method was proposed for studying the class of singular integral equations systems for a limited monomeric field, simple formulas were obtained for calculating indexes, and solvability conditions were found. A spectral theory of equations with partial products of an elliptical type and confluences in manifolds was worked out.

Today, mathematicians are paying a great deal of attention to resolving concrete national economic tasks, in particular, to problems connected with the utilization and reclamation of new irrigation land and the deformation of river channels.

Physicists are credited with much important fundamental research, primary among which is the study of nuclear interactions at superhigh energies using pulse chambers mounted at great absolute altitudes in the Pamirs. This research is being done in cooperation with leading physics scientific research institutions here and in the Polish People's Republic. Valuable materials of fundamental importance to studying nuclear processes and to elementary particle physics were obtained as a result of the "Pamir" experiment.

Physicists have worked out a molecular-kinetic theory of migration phenomena in condensed media; they have proposed a kinetic theory of a two-liquid model of a substance, studied the molecular mechanism of relaxation processes in gases and liquids, and calculated a dynamic form-factor which has yielded a law of radiation dispersion near the critical point of a substance.

Spectroscopic methods have been developed for precision structural analysis of cotton and systematized structural criteria have been developed for various selected varieties, including those damaged by wilt.

There have been major achievements in the field of quantum electronics and semiconductor physics, in growing new classes of monocrystals on antimony and phosphorous bases, in the concrete application of the express neutron-activation method of determining an element series. New materials with valuable properties have been obtained. A number of semiconductor alloys needed by tool-making industry have been studied.

There has been significant fundamental research by astrophysicists in the field of meteor and comet astronomy. They have discovered a negative polarization and opposition effect of comet irradiation of the atmosphere and have found a precise solution to the nonlinear integral equation describing the features of comets with optically dense atmospheres as self-regulating systems. An effective method has been developed for predicting the observed intensiveness of meteor showers, the influx of meteor subtance on the Earth has been evaluated and instantaneous meteor spectrograms have been obtained; numerical research has been done on the perturbation effect of planets and a number of physical nongravitational factors on the movement of meteor bodies in the solar system; the variability mechanism of certain types of nonstationary stars has been studied. Together with Moscow State University imeni M. V. Lomonosov, a method of studying the spectral structure of the galaxy has been proposed. In the field of meteor research, our astrophysicists are USSR and world leaders.

Chemists have done fundamental research on the geochemistry of a number of elements in sedimentary rock in southern Tajikistan, on revealing the mechanism whereby a reagent interacts with the surfaces of nonferrous and rare metal minerals, on perfecting the flow charts and procedures of flotation processes, on obtaining fundamentally new materials for modern equipment, on synthesizing chlorides and oxychlorides of tungsten, molybdenum and other refractory elements, on studying the growth mechanism of cotton histones, coal oxidation and the synthesis of a number of classes of biologically active substances.

Possible ways of deriving a number of valuable components suitable for use as flotoreagents, compounds to combat agricultural pests, surfactants made from high-sulfur petroleum wastes, as well as dyes made from the oxidation products of coals in Tajik deposits, were established.

Methods were worked out for obtaining new biocid active dyes, methods of painting and finishing items made from filament polymers, fibrous sorbents for the sorbtion and removal of platinic minerals, synthesizing thermostable polyamid polymers for new fields of technology, and utilizing cotton-ginning industry wastes; a new KTADAF reagent was proposed for determining microquantities of cobalt and nickel in material and natural substances. Ten new acetylene-series substances were obtained and their properties were studied.

Research by geologists has won wide recognition. They have substantiated the stratigraphic importance of a number of groups of mineral organisms; new stratigraphy procedures have been worked out for anthracite, Jurassic, Cretaceous and paleogenic deposits in Tajikistan; biostratigraphic zoning has been done. A procedure has been developed for the tectonic zoning of the Pamirs; the boundary-zone fractures of Tajikistan and their seismogenerative role were studied; a special type of folding -- auto-folding -- and its genesis were established. Sediment formations and the minerals associated with them were studied (titanium and bauxite ores of the Pamirs). A fundamental description of magmatism in the Karategin, Pamirs and Central Tajikistan was developed. Structural models were made of the Earth's crust in Gissaro-Alay and the Pamirs. The mineralogy of important types of deposits in Tajikistan and the physicochemical conditions under which ores are formed were described; a new (Central Pamirs) gemstone and commercial rock province was revealed. The presence of a considerable reserve of groundwater suitable for irrigation and other purposes was substantiated; the

thermomineral sources for balneological purposes and bottling were studied; an engineering-geological map of the republic was drawn up. The recommendations by geologists on organizing searches for individual types of mineral raw material are being successfully actualized in the practical activity of production geological organizations.

Work by scientists in the field of seismology and earthquakeproof construction has won unionwide recognition and is known far beyond the borders of our country. A comprehensive approach to predicting earthquakes in Tajikistan has been worked out, enabling us to predict seismic points in 1976 and 1979; a forecast map has been drawn up of places where strong earth tremors could arise. A map drawn up of seismic zones in Tajikistan was awarded the Tajik SSR State Prize in the Field of Science and Technology imeni Abuali ibn Sino, and seismic microregion maps of a number of republic cities have been drawn up.

The seismic danger at the Rogunskaya GES was calculated and recommendations were issued for planning the complex of its facilities. Methods of calculating seismic stability of earthen dams have been refined using the Nurekskaya GES as an example, and the seismic stability of a calculation model of the Rogunskaya GES dam has been evaluated.

The multifaceted, fruitful scientific activity of biologists of the Tajik Academy of Sciences has been devoted to the study of republic flora and fauna which has been continuing for more than 100 years, to problems of improving agricultural efficiency and protecting the most valuable and fastest-disappearing types of animals and plants. Problems of using and reproducing plant resources have been developed with a view towards strengthening the fodder base of stockraising, and recommendations have been made on improving the natural herbage through the surface application of mineral fertilizers, on introducing high-yield fodder plants into cultivation, and on landscaping cities and the sites for industrial projects.

The scientific principles for an integrated system for protecting cotton from pests have been developed and the system is being introduced widely into agricultural production; its main platform is the intelligent combining of chemicals with the biological regulating mechanisms of the agrobiocenosis of the cotton field itself on a background of high agrotechnical standards.

A method was developed for treating cattle theileriosis and a compound for that treatment was developed for the first time. Practical testing of the compound showed it to be highly effective. Work was done on combatting open-ground vegetable crop gall nematodes. Cotton hybrids with high photosynthesis potential were obtained.

Methodology for deriving new donors of cotton immunity to verticillium wilt pathogens was developed. Immunity donors with comprehensive wilt-resistance were derived for the most pest-plagued breeds. Recommendations were made on setting up the republic's first national park in the Pamirs. A preliminary forecast was made of the influence of mining industry on the environment in the vicinity of the Southern-Tajik territorial production complex for the period up to 1990.

Practical medicine has proposed a new nonsurgical method of stopping and preventing massive esophageal bleeding in patients with portal hypertension and a method

of treating slow-healing gastric ulcers which enables us to increase mucosa reparation directly in the ulcer crater. Clinical, functional and morphological criteria were formulated for identifying and differential diagnosis of alcohol and virus hepatitis.

Social scientists have achieved significant successes. Their primary efforts have been focused on problems of developing the spiritual culture of the Soviet people, generalizing experience in building socialism, studying the economic and social problems of developed socialism and its growth into communism. The experience of backward peoples' changing over to socialism directly, by-passing capitalism, has been generalized through the joint efforts of historians, economists, philosophers and jurists. Extensive research has been done on the history of the Tajik people from ancient times to the present day. The large-scale work by and discoveries of Tajik archeologists have won worldwide recognition. Preparation of an "Archeological Map of Tajikistan" is being completed; it will take into account all the archeological monuments of our republic, without exception.

Much work has been done on studying the classical written legacy and oral creative power of the Tajik people.

Among the most important achievements of our philologists are their objectively historical analysis of the process of shaping Tajik-Persian literature and their Marxist evaluation of the creativity of its most prominent representatives: Rudaki, Firdousi, Omar Khayam, Nosir Khisrou, Saadi, Khafiz, Kamol Khodzhandi, Dzhami and Akhmad Donish. Philologists have developed the theoretical problems of the establishment and development of the literature of socialist realism under the benevolent influence of Russian classical realist literature and its founders: M. Gor'kiy and V. Mayakovskiy. They have comprehensively analyzed the creativity of S. Ayni, A. Lakhuti and M. Tursun-zade, to whose names the strong development of modern Tajik culture is linked.

Much that is of theoretical and practical interest is contained in works by economists devoted to developing the general prospects for developing and distributing productive forces, improving the effectiveness of the republic national economic complex, the socioeconomic development of the Tajik SSR, development of a comprehensive program for shaping and developing the South Tajik territorial production complex and territorial production organizations by republic oblast and zone up to the year 2000.

The ties between science and production are being strengthened year by year and the forms of these ties are being perfected.

Academy of Sciences institutions are participating in the development of assignments for 12 union and six republic scientific-technical programs and are conducting research on six union-level problems.

During the 10th Five-Year Plan, a promising form of scientific research organization on the basis of long-term agreements on scientific and scientific-technical cooperation among the Tajik SSR Academy of Sciences, ministries, departments and individual large enterprises arose and was developed. Scientists and specialists of the Academy of Sciences, branch scientific-research institutions and

production collectives of the republic ministries, the Tajik SSR Geology Administration, "Tadzhiktekstil'mash" plant imeni F. Dzerzhinskiy -- all are conducting scientific research under these agreements. Similar agreements link the Academy of Sciences with the USSR Ministry of Nonferrous Metallurgy and a number of its mining enterprises, with the Belorussian SSR and Uzbek SSR academies of sciences.

Traditional forms of working on orders from production organizations on economic-agreement principles play a substantial role. Scientific institutions of the Academy of Sciences completed 292 projects totalling nearly 11.2 million rubles under direct agreements during the 10th Five-Year Plan, exceeding the amount of economic-agreement work in the 9th Five-Year Plan 2.3-fold. At the same time, the scientific and practical value of the economic-agreement projects increased, with many becoming perennial.

Some 154 developments were introduced in various branches of the national economy during 1976-1981 in close cooperation with the ministries and departments. Thus, the scientific achievements of astrophysicists are being successfully actualized in resolving the applied tasks of geodesy, geophysics and meteorology. A new method of long-range forecasting of strong earth tremors has been proposed on the basis of fundamental research by seismologists, who have also worked out an express method of decreasing stress in the [epi]center. Using the Nurekskaya GES as an example, the influence of reservoir filling on seismicity and other geophysical environmental parameters was demonstrated. Proposals were made on recording the influence of reservoir filling on the seismicity of an area. More than 40 proposals by scientists based on research results in the field of seismology and construction earthquake resistance have been used in practical planning and construction within the republic, including for such hydroelectric power engineering giants of Central Asia as the Nurekskaya and Rogunskaya GES's.

Research done at the Institute of Chemistry imeni V. I. Nikitin has permitted the development of effective procedures for enriching antimony-mercury, copper-bismuth, boron, lead and fluorite ores. Scientists have proposed fundamentally new flotation agents -- carbinol for enriching lead-zinc and other sulfide ores and microbic fat for enriching fluorspar ores. Use of the latter for ore flotation at the Takobskiy combine ensures a reduction in the hazardous silicon dioxide content in the concentrate and increases the extraction of fluorite from the concentrate.

The bactericide monochlortriazin active dyes developed in cooperation with the UkrNIIV [probably: Ukrainian Scientific Research Institute of Synthetic Fibers] and protected by USSR author's certificates and patents in the USA, Britain, France and Switzerland, have been recommended, after successful testing, for the manufacture of items preventing certain skin diseases. A thickening agent for printer's inks proposed by republic chemists is being used at a number of republic enterprises.

The results of theoretical and experimental work by physicists on quantum generators are being used in a number of new fields of modern engineering and technology.

Methods of cold press-fitting parts in various assembly operations have been introduced at Tajik SSR State Sel'khoztekhnika Committee enterprises, at the

"Tadzhiktekstil'mash" plant imeni F. Dzerzhinskiy and at repair shops of the survey drilling expedition.

A dye formula for applying drawings to knitwear, which was proposed by our physicists, is being used successfully at the Uratyubinsk Knit Outerwear Factory.

Technology developed by chemists for obtaining a number of aluminum-based alloys is being actualized. When they are used as modifiers of linear aluminum alloys, the physicomechanical properties of the castings improve.

Work done by scientists in close cooperation with agricultural specialists is of enormous importance to improving the effectiveness of agricultural production. Thanks to their joint efforts, the change-over from continuous nonsystemic chemical treatment of cotton fields to an integrated system of cotton pest control has been practically completed in recent years, thus achieving a sharp reduction in the scope of chemical treatment, guaranteeing protection of the environment from pollution by toxic chemicals, and ensuring additional protection of the cotton harvest. The theoretical and practical results of work on the integrated system for protecting cotton from pests have been approved by the USSR Academy of Sciences and the VASKhNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin] and the system has been recommended for broad application on all republic cotton acreage.

A system for year-around utilization of cotton lands has undergone production testing. Using the system developed, which anticipates regulating cotton productivity by treating plants with physiologically active substances, can increase the raw cotton yield and accelerate harvesting by 15-20 days, which permits growing winter-growth fodder crops on the land thus freed and ensures high fodder yields of up to 250-400 q/ha.

In scientific cooperation with the Farming Scientific Research Institute, the Tajik SSR Ministry of Agriculture has developed and is successfully introducing a new method of chemically chopping cotton which uses a "round" compound which ensures faster maturation and higher yields of raw cotton. The economic impact of using this method is 60-80 rubles per hectare.

The total economic impact of introducing the scientific developments of biologists in 1981 was more than 4.5 million rubles.

Invention and patenting-licensing work has become an increasingly inseparable part of scientific research work in Tajik SSR Academy of Sciences institutions. In the course of scientific research and experimental-design work in 1976-1981, three applications for proposed discoveries and 476 invention applications were submitted to the USSR State Committee for Inventions and Discoveries, resulting in the issuance of 224 author's certificates for inventions and six patent awards.

The achievements of Soviet Tajikistan science have won international recognition. The ties between scientists of the Tajikistan Academy of Sciences and scientists and scientific institutions of foreign countries grow broader and stronger with each passing year. Our scientists participate in congresses, conferences and other international scientific forums held abroad; they travel to familiarize themselves with the achievements of foreign science and engineering, render the

developing countries scientific consultative assistance, conduct joint research and discussion of the results, exchange scientific literature, and so forth.

Scientific research institutions of the Tajik SSR Academy of Sciences, jointly with scientific centers of the socialist countries, conduct research on seven problems and participate in seven scientific programs with capitalist countries. For example, they participate in the "Interkosmos" program in multilateral cooperation with the academies of sciences of the socialist countries.

Fruitful scientific ties have evolved with scientists of the Democratic Republic of Afghanistan. With the active participation of Tajik scientists, this country has created the first academy of sciences in its history. The departments of botany and seismology of the natural sciences center of the DRA Academy of Sciences are now being equipped with scientific apparatus with the help of the Tajik SSR Academy of Sciences. Associates at the institutes of social sciences are preparing textbooks for the secondary schools of Afghanistan and are translating sociopolitical literature into the Dardic language [sic]. Afghanistan scientists are training on the job at scientific institutions of the Tajik SSR Academy of Sciences and conducting joint research there.

Governed by the historical resolutions of the 26th CPSU Congress and the 19th Congress of the Tajikistan Communist Party, the republic Academy of Sciences plans a broad program of research on pressing problems of modern science, proceeding from the tasks of further developing the economy and culture of the republic. En route to carrying our this responsible task, a special place is being given to fundamental research as a source of new technical resolutions and an important factor in accelerating scientific-technical progress.

3. Year by year, the scientific ties of the academies of sciences of the republics of Central Asia and Kazakhstan are being strengthened. In recent years, geological and biological problems of mastering mountainous and desert territory, problems of seismology and earthquake-resistant construction, the industrial use of plant resources, developing the cotton-growing complex and productive forces, use of solar energy and environmental protection have been successfully developed through joint efforts in recent years. Considerable work is being done, for example, within the framework of the regional problem "Comprehensive Study and Mastering of Arid Territories of Central Asia and Kazakhstan" under the "Khlopok" target comprehensive program.

Social scientists are conducting joint research. In particular, they are completing research on the major problem "History of the Philosophical and Sociopolitical Thought of the Peoples of Central Asia and Kazakhstan."

Region historians are carrying out extensive research on problems of experience in cultural progress in Central Asia and Kazakhstan under socialism under the topic "V. I. Lenin in the Historical Destinies of the Peoples of Central Asia and Kazakhstan" and a summary work, "Historical-Ethnographic Atlas of the Peoples of Central Asia and Kazakhstan." Work is being done on regional problems of building socialism, the interrelationships of nations in the course of shaping a unified historical community, the Soviet people, and on problems of combining the achievements of the scientific-technical revolution with the advantages of the socialist system.

Of course, the scientists of our academies of sciences are still faced with quite a bit of work to raise to a considerably greater height the coordination of their activity and to broaden even more the range of research being done jointly. This will permit the successful resolution of the tasks set Soviet science by the 26th CPSU Congress and a worthy greeting to that remarkable date, the 60th anniversary of the formation of the Union of Soviet Socialist Republics.

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YOUNG SCIENTIST MOLDED IN THE VUZ

Yerevan KOMMUNIST in Russian 9 Feb 83 p 1

[Editorial: "Raising the Scientific Shift"]

[Text] Raising a young replacement shift capable of having its say in science, multiplying its glory and honor and being disinterestedly devoted to the lofty principles and ideals of communism is a glorious tradition of Soviet scientists. Our science's best people are endeavoring to preserve and enrich this tradition.

The Communist Party and the Soviet Government are paying tremendous attention to the formation of new generations of scientists. Striking confirmation of this are the new names of young experts in many branches of learning who have given notice of themselves by independent work which has won recognition, devotion to the chosen cause in life and fascination therewith.

High evaluation of the labor of the young scientists of Soviet Armenia is the conferment on them of the titles of prizewinners. In 5 years, from 1978 through 1982, some 18 young scientists and specialists were awarded the all-union title of Komsomol Prizewinner and 35 that of Armenian Komsomol Prizewinner in the sphere of science and technology.

Among these are last year's winners: the young mathematician G. Varsegyan, the author of a series of research pieces on geometric theory of meromorphic functions; a group of scientists--engineers from Armenia and the Ukraine--S. Bagdasaryan, S. Madoyan, K. Karapetyan, V. Kalinchik and S. Zagorodnyy, who created a data-logic system of controlling industrial enterprises' energy consumption based on microcomputers, the physicists N. Tabiryan, A. Karayan, O. Garibyan and others.

Leaders of the graduate students and those submitting theses have a place in the development of the young scientist and the shaping in him of the qualities of an inquiring, purposeful researcher capable of proceeding along an uncharted road toward the set goal.

The scientist begins in the VUZ. It is here, at the student's desk, that the young person is introduced to research. Work alongside the laboratory and department leader and participation in special research, experiments and the

performance of business contract work is a way to enlist the youth in science that has been proven by practice.

In our time, when broad-scale comprehensive problems are being developed, collective creativity in science is becoming the regular pattern. The young scientific worker is formed in a circle of fellow thinkers united by community of tasks and scientific concepts. And if he works in a collective where benevolence, mutual assistance and cooperation are a law of daily life and where the style of work of the leader and its very rhythm engender a thirst for research and concrete results, the young scientist becomes firmly established in his chosen field.

Vilen Mkrtichevich Aslanyan, professor at the Yerevan State University, doctor of sciences and head of the Molecular Biophysics Department, nurses the young research assistants solicitously, patiently and with love. He conveys his fascination with science, persistence and consistency in achieving the set goal and lofty human qualities to his students and followers. This attitude produces big results. From 1978 through 1982 nine of the professor's graduate students defended theses, 2 will defend them this February and 3 are completing work on their theses. In his best students he values particularly creative assertiveness, persistence, capacity for work and discipline and encourages manifestation of these qualities in every possible way.

Much attention to the training and formation of scientific youth is paid by Prof G. Saakyan, corresponding member of the Armenian Academy of Sciences, Prof N. Manukyan, doctor of sciences, A. Galoyan, member of the republic Academy of Sciences, and other prominent scientists.

In the republic Academy of Sciences Institute of Mathematics the training of highly qualified specialist personnel and reinforcement of the Armenian mathematicians' school has become a firm good tradition. Having defended their theses, the young scientists continue fruitful research work in the most important branches of mathematics, show their worth in the lecturing profession in VUZ's and work in the republic's sectorial scientific research institutes.

Considerable work in this field is being performed in the sectorial scientific research institutes, the Yerevan Scientific Research Institute of Mathematics and Mechanics, the All-Union Scientific Research Institute of Radiophysical Distances and others, for example.

Interesting forms of work with the scientific youth have been firmly established in recent years: public design bureaus, so-called composite creative youth collectives and so forth.

But it would be wrong not to mention the serious shortcomings which exist in the training of scientific personnel. Work is still being performed inadequately in the republic's VUZ's and Academy of Sciences' institutes on selection for graduate work of the best prepared students and assistants who have shown their worth in scientific and public life. Unfortunately, there is a marked tendency toward a weakening of the efficiency of graduate training. The prescribed times for defending work are frequently disrupted.

Last year 19 persons completed graduate training in the Yerevan Polytechnical Institute, for example. Only three of them submitted their theses on time, but not one has yet defended it. The state of affairs in other VUZ's and scientific establishments is little different.

Some of them adopt a formal approach to the planning of graduate training, providing for specialties for which there is no real need. The efficiency of graduate training is low in the technical specialties.

All this is leading to the premature "aging" of the new generation of scientific workers. For example, the average age of candidates of sciences in the physico-mathematical disciplines is 38 here in the republic and that of doctors of sciences 50. In the social sciences 40 and 50.

Years which for the scientist should be a time of the greatest creative results are let slip by. Great responsibility for this lies with the leaders of VUZ departments, scientific research institutes, academic institutes, other scientific subdivisions and scientists of the older generation.

High demands concerning increased performance and state discipline also apply wholly and fully to those who are entrusted in the VUZ's with training the young replacement shift. Yet certain docents, professors and leaders of scientific subdivisions have not prepared candidates of sciences for decades. People who are not capable of performing this responsible mission should be removed. The republic Ministry of Higher and Secondary Specialized Education is already implementing such measures.

The CPSU Central Committee November (1982) Plenum set the task of seeking reserves of an acceleration of scientific-technical progress. One reserve is a further improvement in the training of scientific worker personnel. There is a multitude of things to be done in this field for the party committees. Primarily an increase in the responsibility of scientific leaders of the graduate students, development and improvement of goal-oriented graduate study and extensive use of the resources of the scientific establishments for the preparation of theses.

An improvement in every possible way in the preparation and training of young scientific personnel is a most important task and matter of honor for communists of VUZ's, academic institutes, sectorial scientific research institutes and all scientific subdivisions.

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GEORGIAN CHEMISTRY INSTITUTE'S RESEARCH PAYS OFF

[Editorial Report] Tbilisi KOMUNISTI in Georgian on 22 February 1983 page 2 carries a 1000-word piece by G. Chivadze, secretary of the party buro in the Academy of Sciences Physical and Organic Chemistry Institute, concerning the institute's research and development efforts in light of the GCP Central Committee's Sixth Plenum's emphasis on getting scientific applications into production. Among other contributions, the institute has developed a number of compounds to control crop pests and diseases, done fundamental research on the practical uses of zeolites in various economic sectors, and collaborated closely with industrial and research colleagues to develop copper powder metallurgy. The institute's overall payback is 2.1 rubles per research ruble invested. The author does note the need for better "thermatic planning" under the general rubric of discipline. And he suggests that a unified set of regulations [ustav] be drawn up to figure economic returns on research and development efforts, a project which the Institute of Economics and Law is in fact now working on.

CSO: 1813/819

ACADEMY OF SCIENCES INFORMATION GIVEN

[Editorial Report] Ashkhabad SOVET TURKMENISTANY in Turkmen 21 December 1982 p 2 carries a 1000-word interview with Fuat Fayzrakhmanovich Sultanov, Secretary of the Presidium of the TSSR Academy of Sciences, on current personnel and directions being taken by the Academy. "Now there are 21 Academicians and 28 Corresponding Members in the Academy. There are also 1037 scientific workers of whom 48 are Doctors of Science and 443 Candidates." Institutionally "there are 14 scientific research administrations which are united in 3 sections: physics, technology and chemistry; biology, and social sciences." It is noted that "natural and socio-economic conditions defined the basic scientific directions of growth in the republic. Study and mastery of desert conditions, exploitation of solar energy in the economy, research into the adaptation of human and animal organisms to hot climate and solar-earth physics have had great growth in the Academy."

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